FINAL SUBMITTAL

ENERGY SURVEYS OF

ARMY INDUSTRIAL FACILITIES

ENERGY ENGINEERING ANALYSIS PROGRAM

RADFORD ARMY AMMUNITION PLANT

RADFORD, VIRGINIA

VOLUME IV

PROGRAMMING DOCUMENTS

CONTRACT NO. DACA65-89-C-0154

PREPARED FOR:

U.S. ARMY CORPS OF ENGINEERS
NORFOLK, VIRGINIA

PREPARED BY:

ENERGY AND ENVIRONMENTAL SERVICES DEPARTMENT
REYNOLDS, SMITH AND HILLS, INC.
P.O. BOX 4850
JACKSONVILLE, FLORIDA 32201

MARCH 1991

DEPARTMENT OF THE ARMY
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS
P.O. BOX 9005
CchampaIGN, ILLINOIS 61826-9005

REPLY TO
ATTENTION OF: TR-I Library

17 Sep 1997

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Marie Wakefield,
Librarian Engineering

TABLE OF CONTENTS

ORIP

- GP-X-2 - Reduce Water Flow to Incinerator (one unit only)
- SR-I-1 - Remove Steam Coils in Activated Carbon Area
- GP-N-3 - Replace Exterior Incandescents with Fluorescents
- GP-X-4 - Install Turning Vanes in Boiler Ductwork
- NC-X-1 - Modify Boiling Tub Heating Method (one tub only)

OSD PIF

- GP-B-4 - Install Variable Frequency Drives
- GP-N-1 - Replace Incandescents with 35W HPS Screw-Ins
- GP-X-6 - Change Incinerator Fuel to Natural Gas

ECAM

- FN-U-1 - Cover Water Dry Tanks with Insulating Spheres (one tank only)
- GP-N-8 - Replace Incandescents with Color-Corrected HPS Screw-Ins
- GP-N-2 - Replace Incandescents with Circline Fluorescents

QRIP

DOCUMENTATION FOR PRODUCTIVITY CAPITAL INVESTMENT PROGRAMS
For use of this form, see AR 5-4; the proponent agency is OCA.

1. PROJECT NO.

REQUIREMENT CONTROL SYMBOL DD-M(R) 1561

2. TO: CDR, AMC (AMCRM-MP)
5001 Eisenhower Avenue
Alexandria, VA 22333-0001

3. THRU:

4. FROM: CDR, AMCCOM
Attn: AMSMC-MGP-P (R)
Rock Island, IL 61299-6000

5. DOD COMP NAME: Army

6. DOD COMP CODE: A

7. COMMAND CODE: W73QKK

8. DATE:

9. PROJECT TITLE: Reduce Water Flow to Incinerator (ECO GP-X-2)

10. TYPE OF PROJECT (Check one): [X] QRIP [ ] OSD PIF [ ] PECIP

11. AMORTIZATION YEARS/MONTHS: $ 7,029 (Project Cost) ÷ 8,416 (Average Annual Savings) X 12 (No. Mos) = -- (years) or 10 (months) (amortization)

12. FUNCTIONAL AREA WHERE SAVINGS WILL OCCUR: 024

13. ECONOMIC LIFE: 25 yrs.

14. EXPECTED OPERATIONAL DATE:

15. SUBMITTING UNIT(S): Administrative Contracting Office
Radford Army Ammunition Pt.
Radford, VA 24141

16. UNIT ID CODE: WOLLAA

17. PROJECT DESCRIPTION: A hydroclone (hydraulic cyclone separator) will be installed at the propellant inlet to one incinerator to reduce the amount of water to be evaporated.

18. DETAILED JUSTIFICATION: Installing a hydroclone will reduce the amount of water to be evaporated by the incinerator and therefore, reduce the amount of fuel oil consumed.

19. SAVINGS DISPOSITION: Savings are used to reduce energy costs.

20. OTHER REMARKS (Continue on page 6, if more space is needed)

1 August 1982

21a. SUMMARY OF DOLLAR SAVINGS
(ROUND OFF TO THE NEAREST DOLLAR)

Attach computation sheet identifying the method and source of data for savings

SAVINGS BREAKOUT	PRESENT METHOD	PROPOSED METHOD 1ST YR	PROPOSED METHOD 2D YR	PROPOSED METHOD 3D YR	PROPOSED METHOD 4TH YR	DIFFERENCE/SAVINGS 1ST YR	DIFFERENCE/SAVINGS 2D YR	DIFFERENCE/SAVINGS 3D YR	DIFFERENCE/SAVINGS 4TH YR
SALARY/LABOR/ OVERTIME									
MATERIAL/ SUPPLIES									
UTILITIES									
MAINTENANCE/ REPAIR									
TRANSPORTATION									
LEASE COSTS									
SALVAGE/ TURN-IN									
ENERGY *(Identify)* #2 fuel oil	171,882	163,466	163,466	163,466	163,466	8,416	8,416	8,416	8,416
CONTRACT COSTS									
OTHER *(Identify)* _____									
TOTALS	171,882	163,466	163,466	163,466	163,466	8,416	8,416	8,416	8,416

b. PRIORITIZATION

(1) INTERNAL RATE OF RETURN *(IRR)*

Divide estimated project cost 7,029 by average annual savings 8,416 = 0.84 factor.

Based on factor and number of years economic life of the project, select the IRR from Table H-3, App H, Ch. 5, AR 5-4 = 295 % IRR.

(2) SAVINGS TO INVESTMENT RATIO *(S/I)*

Multiply annual savings 8,416 X discount factor 17.06 = 143,577 and divide by present value of investment *(undiscounted)* 7,029 = 20.4 S/I.

(Based on economic life 25 years, select discount factor from Table H-4, App H, Ch. 5, AR 5-4.

(3) RATE OF INVESTMENT PER MANPOWER SPACE *(RIMS)* NA

Divide estimated project cost _____ by number of manpower space savings _____ = _____ RIMS.

(Manpower requirements cannot be used in this computation.)

22. COST FOR PROJECT TO BECOME OPERATIONAL

EQUIPMENT TYPE a	PROPOSED SOURCE OF PROCUREMENT b	UNIT PRICE c	QUANTITY d	TOTAL COST e	APPROPRIATION, BUDGET ACTIVITY OR PROGRAM ELEMENT f	FY FUNDS REQUIRED g
(1) Hydroclone		7,029	1	7,029		
(2)						
(3)						
(4)						
(5)						
(6) TRANSPORTATION (Equipment delivery)						
(7) EQUIPMENT MODIFICATION[1]						
(8) EQUIPMENT INSTALLATION						
(9) MAINTENANCE CONTRACT[2]						
(10) FACILITIES MODIFICATION[3]						
(11) TRAINING						
(12) OTHER (Specify):						
(13) TOTAL REQUIRED FOR PROJECT TO BECOME OPERATIONAL[4]				7,029		
(14) TOTAL AMOUNT OF FUNDING REQUESTED IN THIS PROPOSAL				7,029		
(15) TOTAL AMOUNT OF FUNDING REQUIRED FROM OTHER SOURCE[5]				0		
(16) TOTAL (Sum of (14) + (15) above)				7,029		

[1] *Not to exceed 10% of equipment cost for QRIP projects.*

[2] *Applicable to OPA QRIP provided cost is included in packaged deal involving one bill for the equipment and initial maintenance.*

[3] *Normally not OPA funded.*

[4] *Used to compute amortization in Item 11.*

[5] *Specify source to include certification that funds are available, if financed from the regular budget:*

23. SUMMARY OF SAVINGS *(MANPOWER AND DOLLARS)*

ITEMS	SAVINGS			REAPPLICATION OF SAVINGS					
	NO. MPR OR MHR	TYPE PERS[6]	DOLLARS	PROGRAM ELEMENT		TDA PARA AND LINE		FUNCTION CODE	
a	b	c	d	e. FROM	f. TO	g. FROM	h. TO	i. FROM	j. TO
(1) REQUIREMENTS AND AUTHORIZATIONS ELIMINATED									
(2) REQUIREMENTS ONLY ELIMINATED									
(3) BORROWED MILITARY MANPOWER RELEASED									
(4) OVERHIRES OR TEMPORARIES TERMINATED									
(5) HOURS OVERTIME ELIMINATED									
(6) MANHOURS SAVED FROM MULTIPLE POSITIONS[7]									
(7) OTHER DOLLAR SAVINGS *(Excluding Manpower)*, e.g., CONTRACT COSTS & UTILITIES			8,416						
(8)									
(9)									
(10)									
(11) TOTAL DOLLAR SAVINGS			8,416						

[6] *(1) US Graded*
(2) US Wage Board
(3) DHFN
(4) IHFN
(5) Officer
(6) WO
(7) Enlisted

[7] *Reflect specific duties being performed with additional manhours available (equivalent manyears)*

24. REGULATORY APPROVAL/COORDINATION

a. INVESTMENT STATEMENT

This proposal has been reviewed and it cannot be implemented with existing equipment or facilities. This investment is in accordance with established investment planning. The project complies with public laws, OSD policies and regulations, and all other regulatory constraints.

_____

(Cite regulatory approvals, e.g., TAGO Control No.) (Ex. New Start, TAGO Approval, etc.)

b. OTHER COORDINATION *(Functional Coordination at local level, e.g., Fac Eng, Log, Pers, etc.)*

_____

_____

26. SUBMITTED BY *(Typed name, grade and title of Subordinate Command/Agency or Project Initiator)*	SIGNATURE	DATE *(YYMMDD)* AUTOVON
28. APPROVAL RECOMMENDED BY *(MACOM/Agency)*	SIGNATURE	DATE *(YYMMDD)* AUTOVON

FOR USE BY HQDA ON OSD PIF PROJECTS ONLY

27. APPROVED BY	SIGNATURE	DATE *(YYMMDD)* AUTOVON

30. OTHER REMARKS *(Cont'd)*

Figure H–1. Documentation for Productivity Capital Investment Program (DA Form 5108–R)—Continued.

RS&H®

SUBJECT _____ AEP NO _____

SHEET _____ OF _____

DESIGNER G. FALLON DATE 6/14/90

CHECKER D. Hutchins DATE 6/14/90

ECO # GP-X-2 REDUCE WATER FLOW INTO INCINERATOR

Combustion Program

The combustion program was adapted to eliminate boiler Absorbtions of Heat by zeroing the appropriate parameters. Those are shown on the "INPUT" pages of the ENCLOSED RUNS.

The Incinerator evaporates 2000 LBS/HR of WATER. THE FUEL FLOW Necessary TO ACCOMPLISH THAT while maintaining A 1000°F EXIT GAS TEMPERATURE WAS DETERMINED BY ITERATION. This relationship was subsequently maintained for the REMAINING computer runs.

The graph was Generated by varying THE WATER FLOW (and therefore Fuel FLOW) while maintaining the 1000°F Exit GAS Temperature.

ENERGY LOSS AT 2000 LBS/HR H_2O

COMPUTER SHEETS

ENERGY LOSS FROM ~~PAGE~~ 1A = 4.45 MBTU/HR

ENERGY LOSS AT 1800 LBS/HR H_2O

COMPUTER SHEETS

ENERGY LOSS FROM ~~PAGE~~ 1K = 4.00 MBTU/HR

ANNUAL ENERGY SAVED FROM EACH INCINERATOR

DATA SHOWS 50% INCINERATOR LOAD FACTOR

$(4.45 - 4.00)$ MBTU/HR $\times$ 8760 HR/YR $\times .5$ = 1971 MBTU/yr

ENERGY SAVINGS FOR BOTH INCINERATORS

1971 MBTU/yr $\times 2$ = 3942 MBTU/yr

RS&H®

SUBJECT _____ AEP NO _____

SHEET _____ OF _____

DESIGNER PH DATE 10/29/90

CHECKER _____ DATE _____

For QRIP

Current energy use for 1 incinerator

From Table 2-1 annual fuel oil bill is

$343,763 (Other, #2 fuel oil)

For one incinerator

$343,763/2 = $171,882/yr.

Savings for one incinerator hydroclone is

3942/2 = 1971 mBtu fuel oil

Value of savings =

1971 * $4.27 = $8416/yr.

ADIABATIC FLAME TEMPERATURE &
COMBUSTION CALCULATIONS

****
I N P U T- I N P U T- I N P U T- I N P U T- I N P U T- I N P U T-
****

CLIENT	COE	DATE	14-Jun-90
PLANT	RAAP	TIME	12:31 PM

FUEL ULTIMATE ANALYSIS

CONSTITUENT	WT.PCT.	DRY FUEL RECEIVED	DRY & ASH FREE	ADJUSTED FUEL
CARBON	12.48	86.40	86.40	86.40
HYDROGEN	1.83	12.70	12.70	12.70
OXYGEN	0.01	0.10	0.10	0.10
NITROGEN	0.01	0.10	0.10	0.10
SULFUR	0.10	0.70	0.70	0.70
CHLORINE	0.00	0.00	0.00	0.00
WATER	85.56	0.00	0.00	0.00
INERTS	0.00	0.00	0.00	0.00
TOTAL	100.00	100.00	100.00	100.00

FUEL RATE (TONS/DAY)	28
TOTAL AIR ASSIGNED (%)	115
FUEL HIGHER HEATING VALUE (BTU/LB)	1902
HEAT LOSS DUE TO UNBURNED CARBON (%)	0.00
CARBON IN RESIDUE (%)	0.00
EXIT GAS TEMPERATURE (Deg. F)	1000
AMBIENT DRY BULB TEMP (Deg.F)	80
HUMIDITY RATIO (LBS H2O/LB DRY AIR)	0.0132
BAROMETRIC PRESSURE (IN.Hg.)	29.92
RADIATION LOSS (%)	0.00
UNACCOUNTABLE LOSS (%)	0.00
ENTHALPY ADDED IN BOILER (BTU/LB)	0

ADIABATIC FLAME TEMPERATURE &
COMBUSTION CALCULATIONS

****
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****

CLIENT	COE	DATE	14-Jun-90
PLANT	RAAP	TIME	12:31 PM

HEAT LOSSES	MMBTU/HR	PERCENT
IN DRY FLUE GAS	1.31	29.37
FROM H2O IN AIR	0.02	0.35
FROM H2O IN FUEL--SENSIBLE	0.50	11.21
FROM H2O IN FUEL--LATENT	2.63	59.06
TOTAL IN WET FLUE GAS	4.45	100.00
DUE TO UNBURNED CARBON	0.00	0.00
DUE TO HOT ASH	0.00	0.00
DUE TO RADIATION & UNACCOUNTABLE	0.00	0.00
TOTAL	4.45	100.00

BOILER EFFICIENCY (%)	0.00
STEAM GENERATED (LBS/HR)	ERR
UNBURNED CARBON (LBS/HR)	0
LBS OF WET FLUE GAS PER LB FUEL	3.41
SPEC.VOL.OF WET FLUE GAS (CU.FT./LB)	42.47
AIR TO FUEL RATIO (LB AIR/LB FUEL)	2.38
COMB. AIR SPECIFIC VOL. (CU.FT/LB)	13.712
COMBUSTION AIR FLOW (LBS/HR)	5635

F L U E G A S A N A L Y S I S

	% BY VOLUME		% BY WEIGHT	
	WET	DRY	WET	DRY
CO2	7.64	13.39	13.41	19.38
SO2	0.0232	0.0406	0.0592	0.0856
O2	1.65	2.89	2.11	3.04
HCL	0.0000	0.0000	0.0000	0.0000
N2	47.77	83.68	53.61	77.49
H2O	42.91		30.81	

F L U E G A S F L O W S

	WET	DRY
MASS (LBS/HR)	7972	5516
VOLUME (ACFM)	5643	3222
(SCFM)(70DEG.F.)	2049	1170
@ 12% CO2	1305	1305
"F" FACTOR (DSCF/MMBTU @12% CO2)		17605

ADIABATIC FLAME TEMPERATURE &
COMBUSTION CALCULATIONS

****
INPUT- INPUT- INPUT- INPUT- INPUT- INPUT-
****

CLIENT	COE	DATE	14-Jun-90
PLANT	RAAP	TIME	06:54 PM

FUEL ULTIMATE ANALYSIS

CONSTITUENT	WT.PCT.	DRY FUEL RECEIVED	DRY & ASH FREE	ADJUSTED FUEL
CARBON	12.48	86.40	86.40	86.40
HYDROGEN	1.83	12.70	12.70	12.70
OXYGEN	0.01	0.10	0.10	0.10
NITROGEN	0.01	0.10	0.10	0.10
SULFUR	0.10	0.70	0.70	0.70
CHLORINE	0.00	0.00	0.00	0.00
WATER	85.56	0.00	0.00	0.00
INERTS	0.00	0.00	0.00	0.00
TOTAL	100.00	100.00	100.00	100.00

FUEL RATE (TONS/DAY)	25
TOTAL AIR ASSIGNED (%)	115
FUEL HIGHER HEATING VALUE (BTU/LB)	1902
HEAT LOSS DUE TO UNBURNED CARBON (%)	0.00
CARBON IN RESIDUE (%)	0.00
EXIT GAS TEMPERATURE (Deg. F)	1000
AMBIENT DRY BULB TEMP (Deg.F)	80
HUMIDITY RATIO (LBS H2O/LB DRY AIR)	0.0132
BAROMETRIC PRESSURE (IN.Hg.)	29.92
RADIATION LOSS (%)	0.00
UNACCOUNTABLE LOSS (%)	0.00
ENTHALPY ADDED IN BOILER (BTU/LB)	0

ADIABATIC FLAME TEMPERATURE &
COMBUSTION CALCULATIONS

****
O U T P U T-O U T P U T-O U T P U T-O U T P U T-O U T P U T-O U T P U T-
****

CLIENT	COE	DATE	14-Jun-90
PLANT	RAAP	TIME	06:54 PM

HEAT LOSSES	MMBTU/HR	PERCENT
IN DRY FLUE GAS	1.18	29.37
FROM H2O IN AIR	0.01	0.35
FROM H2O IN FUEL--SENSIBLE	0.45	11.21
FROM H2O IN FUEL--LATENT	2.36	59.07
TOTAL IN WET FLUE GAS	4.00	100.00
DUE TO UNBURNED CARBON	0.00	0.00
DUE TO HOT ASH	0.00	0.00
DUE TO RADIATION & UNACCOUNTABLE	0.00	0.00
TOTAL	4.00	100.00

BOILER EFFICIENCY (%)	0.00
STEAM GENERATED (LBS/HR)	ERR
UNBURNED CARBON (LBS/HR)	0
LBS OF WET FLUE GAS PER LB FUEL	3.41
SPEC.VOL.OF WET FLUE GAS (CU.FT./LB)	42.47
AIR TO FUEL RATIO (LB AIR/LB FUEL)	2.38
COMB. AIR SPECIFIC VOL. (CU.FT/LB)	13.712
COMBUSTION AIR FLOW (LBS/HR)	5071

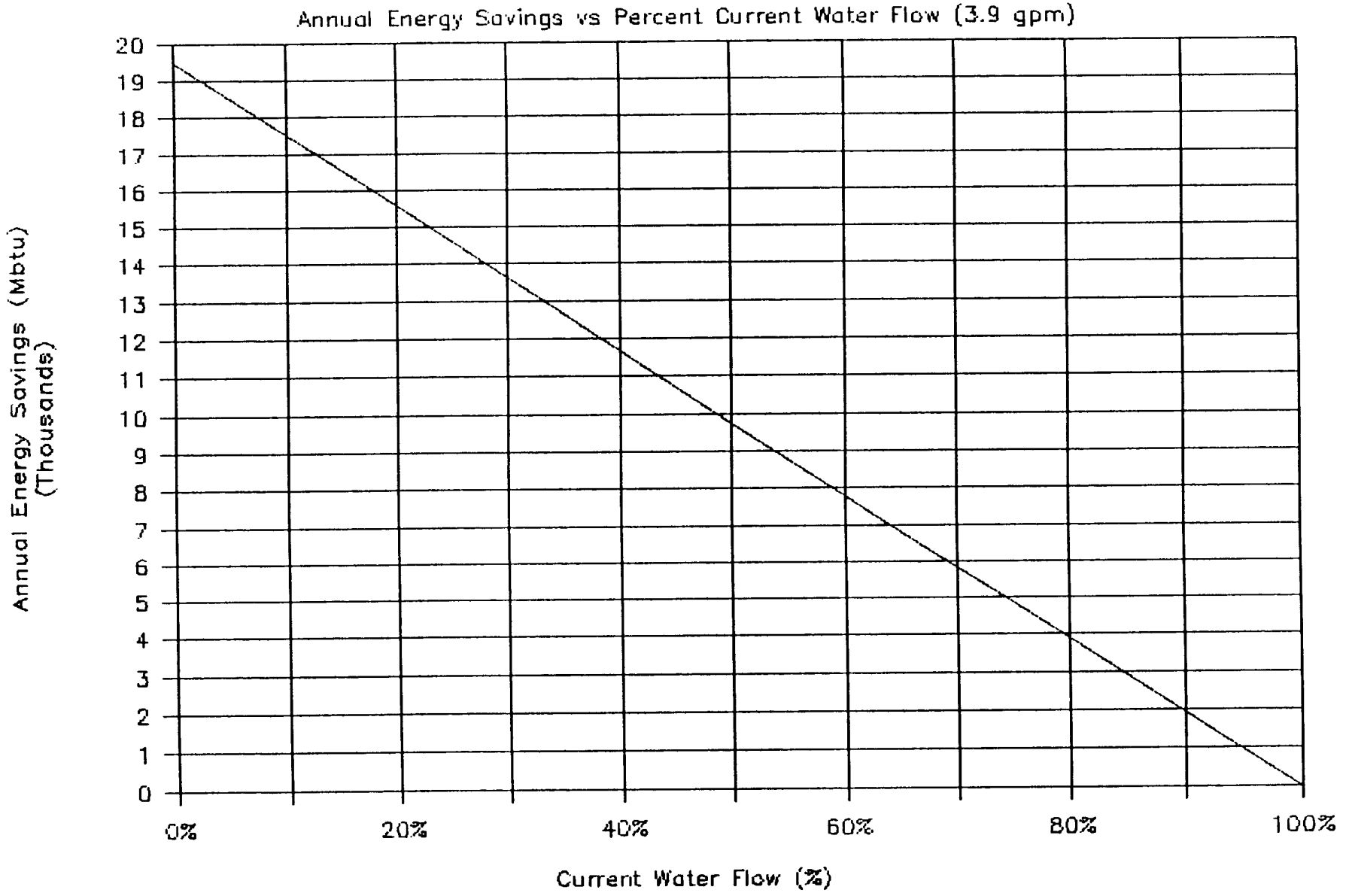
F L U E G A S A N A L Y S I S

	% BY VOLUME		% BY WEIGHT	
	WET	DRY	WET	DRY
CO2	7.64	13.39	13.41	19.38
SO2	0.0232	0.0406	0.0592	0.0856
O2	1.65	2.89	2.11	3.04
HCL	0.0000	0.0000	0.0000	0.0000
N2	47.77	83.68	53.61	77.49
H2O	42.91		30.81	

FLUE GAS FLOWS

	WET	DRY
MASS (LBS/HR)	7175	4964
VOLUME (ACFM)	5079	2899
(SCFM)(70DEG.F.)	1844	1053
@ 12% CO2	1174	1174
"F" FACTOR (DSCF/MMBTU @12% CO2)		17605

Radford Army Ammunition Plant



HUNTER

Telephone Call Confirmation

Project No. 290-0379-000

Local _____ L.D. X Placed X Rec'd. _____ Date 5-22-90

_____ Conversed With _____ (404) 394-6200

Of ~~Dorr~~ DORR OLIVER Regarding HYDROCLONES

1" HYDROCLONE is correct SIZE PROVIDED PARTICLES CAN PASS 4 mm ORIFICE WILL GET 50/50 SPLIT DOWN TO 30 μ AT 50 PSIG ΔP. COST is $400.00

Distribution:

CONSTRUCTION COST ESTIMATE

DATE PREPARED: 5-23-90 | SHEET 1 OF

PROJECT: ENERGY ENGINEERING ANALYSIS

LOCATION: RADFORD ARMY AMMUNITION PLANT

ARCHITECT ENGINEER: REYNOLDS, SMITH AND HILLS A.E.P., INC.

BASIS FOR ESTIMATE
- ☐ CODE A (No design completed)
- ☑ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify)

DRAWING NO.:

ESTIMATOR: G. FALLON

CHECKED BY: RA

ADD HYDROCLONE SUMMARY TO INCIN. SLURRY LINE

	QUANTITY		LABOR		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
1 IN HYDROCLONE	1	EA	30	30	$100	100	130
1" 316SS pipe	300	ft	3.99	1197	7.42	2226	3423
FIBERGLASS INSULATION							
(1") SERVICE JACKET							
1" WALL, 1" pipe	300	CT	1.56	468	1.37	411	879
SUB TOTAL				1695		2737	4402
LOCATION			.683	1158	1.002	2742	3900
SALES TAX (4.5%)				0		123	123
SUB TOTAL				1158		2865	4023
FICA/INSURANCE (20%)							805
SUB TOT							4828
OH (15%)							724
SUB TOT							5552
PROFIT (10%)							555
SUB TOT							6107
BOND (1%)							61
SUB TOT.							6168
CONTINGENCY (7.5%)							463
SUB TOT.							6631
HERCULES SUPPORT (6%)							399
TOTAL							7029
				TWO hydroclones			x2
				TOTAL			$14,058

ENG FORM 1 AUG 59 150 (ER 1110-345-730) PREVIOUS EDITION MAY BE USED

* U.S. GOVERNMENT PRINTING OFFICE : 1990 O—816146

(TRANSLUCENT)

DOCUMENTATION FOR PRODUCTIVITY CAPITAL INVESTMENT PROGRAMS
For use of this form, see AR 5-4; the proponent agency is OCA.

1. PROJECT NO.

REQUIREMENT CONTROL SYMBOL DD-M(R) 1561

2. TO:
CDR, AMC (AMCRM-MP)
5001 Eisenhower Avenue
Alexandria, VA 22333-0001

3. THRU:

4. FROM:
CDR, AMCCOM
Attn: AMSMC-MGP-P (R)
Rock Island, IL 61299-6000

5. DOD COMP NAME: Army

6. DOD COMP CODE: A

7. COMMAND CODE: W73QKK

8. DATE:

9. PROJECT TITLE
Remove Steam Coils from Activated Carbon Area (ECO SR-I-1)

10. TYPE OF PROJECT (Check one)
[X] QRIP [ ] OSD PIF [ ] PECIP

11. AMORTIZATION YEARS/MONTHS
$ 17,057 (Project Cost) ÷ 13,979 (Average Annual Savings) X 12 (No. Mos)
= -- (years) or 14.6 (months) (amortization)

12. FUNCTIONAL AREA WHERE SAVINGS WILL OCCUR
024

13. ECONOMIC LIFE

14. EXPECTED OPERATIONAL DATE

15. SUBMITTING UNIT(S)
Administrative Contracting Office
Radford Army Ammunition Pt.
Radford, VA 24141

16. UNIT ID CODE
WOLLAA

17. PROJECT DESCRIPTION
Remove disconnected preheat steam coils in the activated carbon solvent recovery area and adjust fan drive to provide design air flow with reduced system air pressure.

18. DETAILED JUSTIFICATION

Steam heating coils previously used to preheat outside air entering the charcoal tanks in the activated carbon solvent recovery process. These coils are no longer used and the steam supply has been disconnected. Removing these coils will reduce the total pressure to be overcome by supply air fans.

19. SAVINGS DISPOSITION

Savings are used to reduce energy costs.

20. OTHER REMARKS (Continue on page 5, if more space is needed)

1 August 1982

21a. **SUMMARY OF DOLLAR SAVINGS**
(ROUND OFF TO THE NEAREST DOLLAR)

Attach computation sheet identifying the method and source of data for savings

SAVINGS BREAKOUT	PRESENT METHOD	PROPOSED METHOD				DIFFERENCE/SAVINGS			
		1ST YR	2D YR	3D YR	4TH YR	1ST YR	2D YR	3D YR	4TH YR
SALARY/LABOR/ OVERTIME									
MATERIAL/ SUPPLIES									
UTILITIES									
MAINTENANCE/ REPAIR									
TRANSPORTATION									
LEASE COSTS									
SALVAGE/ TURN-IN									
ENERGY *(Identify)* Electricity	62,123	48,144	48,144	48,144	48,144	13,979	13,979	13,979	13,979
CONTRACT COSTS									
OTHER *(Identify)*									
TOTALS	62,123	48,144	48,144	48,144	48,144	13,979	13,979	13,979	13,979

b. **PRIORITIZATION**

(1) **INTERNAL RATE OF RETURN *(IRR)***

Divide estimated project cost 17,057 by average annual savings 13,979 = 1.22 factor.

Based on factor and number of years economic life of the project, select the IRR from Table H-3, App H, Ch. 5, AR 5-4 = 138 % IRR.

(2) **SAVINGS TO INVESTMENT RATIO *(S/I)***

Multiply annual savings 13,979 X discount factor 8.78 = 122,736 and divide by present value of investment *(undiscounted)* 17,057 = 7.2 S/I.

(Based on economic life 15 years, select discount factor from Table H-4, App H, Ch. 5, AR 5-4.

(3) **RATE OF INVESTMENT PER MANPOWER SPACE *(RIMS)*** NA

Divide estimated project cost _____ by number of manpower space savings _____ = _____ RIMS.

(Manpower requirements cannot be used in this computation.)

22. COST FOR PROJECT TO BECOME OPERATIONAL						
EQUIPMENT TYPE a	PROPOSED SOURCE OF PROCUREMENT b	UNIT PRICE c	QUANTITY d	TOTAL COST e	APPROPRIATION, BUDGET ACTIVITY OR PROGRAM ELEMENT f	FY FUNDS REQUIRED g
(1)						
(2)						
(3)						
(4)						
(5)						
(6) TRANSPORTATION (Equipment delivery)						
(7) EQUIPMENT MODIFICATION[1]						
(8) EQUIPMENT INSTALLATION						
(9) MAINTENANCE CONTRACT[2]						
(10) FACILITIES MODIFICATION[3]						
(11) TRAINING						
(12) OTHER (Specify): Remove coils and adjust fan drives				17,057		
(13) TOTAL REQUIRED FOR PROJECT TO BECOME OPERATIONAL[4]				17,057		
(14) TOTAL AMOUNT OF FUNDING REQUESTED IN THIS PROPOSAL				17,057		
(15) TOTAL AMOUNT OF FUNDING REQUIRED FROM OTHER SOURCE[5]				0		
(16) TOTAL (Sum of (14) + (15) above)				17,057		

[1] *Not to exceed 10% of equipment cost for QRIP projects.*

[2] *Applicable to OPA QRIP provided cost is included in packaged deal involving one bill for the equipment and initial maintenance.*

[3] *Normally not OPA funded.*

[4] *Used to compute amortization in Item 11.*

[5] *Specify source to include certification that funds are available, if financed from the regular budget:*

23. SUMMARY OF SAVINGS *(MANPOWER AND DOLLARS)*

ITEMS	SAVINGS			REAPPLICATION OF SAVINGS					
	NO. MPR OR MHR	TYPE PERS[6]	DOLLARS	PROGRAM ELEMENT		TDA PARA AND LINE		FUNCTION CODE	
a	b	c	d	e. FROM	f. TO	g. FROM	h. TO	i. FROM	j. TO
(1) REQUIREMENTS AND AUTHORIZATIONS ELIMINATED									
(2) REQUIREMENTS ONLY ELIMINATED									
(3) BORROWED MILITARY MANPOWER RELEASED									
(4) OVERHIRES OR TEMPORARIES TERMINATED									
(5) HOURS OVERTIME ELIMINATED									
(6) MANHOURS SAVED FROM MULTIPLE POSITIONS[7]									
(7) OTHER DOLLAR SAVINGS *(Excluding Manpower)*, e.g., CONTRACT COSTS & UTILITIES			13,979						
(8)									
(9)									
(10)									
(11) TOTAL DOLLAR SAVINGS			13,979						

6 *(1) US Graded*
(2) US Wage Board
(3) DHFN
(4) IHFN
(5) Officer
(6) WO
(7) Enlisted

[7] *Reflect specific duties being performed with additional manhours available (equivalent manyears)*

24. REGULATORY APPROVAL/COORDINATION

a. INVESTMENT STATEMENT

This proposal has been reviewed and it cannot be implemented with existing equipment or facilities. This investment is in accordance with established investment planning. The project complies with public laws, OSD policies and regulations, and all other regulatory constraints.

(Cite regulatory approvals, e.g., TAGO Control No.) (Ex. New Start, TAGO Approval, etc.)

b. OTHER COORDINATION *(Functional Coordination at local level, e.g., Fac Eng, Log, Pers, etc.)*

25. SUBMITTED BY *(Typed name, grade and title of Subordinate Command/Agency or Project Initiator)*	SIGNATURE	DATE *(YYMMDD)* AUTOVON
26. APPROVAL RECOMMENDED BY *(MACOM/Agency)*	SIGNATURE	DATE *(YYMMDD)* AUTOVON

FOR USE BY HQDA ON OSD PIF PROJECTS ONLY

27. APPROVED BY	SIGNATURE	DATE *(YYMMDD)* AUTOVON

28. OTHER REMARKS *(Cont'd)*

Figure H–1 Documentation for Productivity Capital Investment Program (DA Form 5108–R)—Continued.

REYNOLDS, SMITH AND HILLS
ARCHITECTS • ENGINEERS • PLANNERS
INCORPORATED

SUBJECT RAAP EEAP
Remove Steam Coils
DESIGNER W. T. Todd
CHECKER BA

AEP NO 2900379000
SHEET 1 OF
DATE 5/21/90
DATE 6/12/90

ECO# SR-I-1

REMOVE STEAM COIL FROM A.C.S.R. DUCTWORK

Assumptions:

1. The 450 hp exhaust fan motors are oversized by 20%.
2. The total pressure on the fan is 20 inches of water.
3. The efficiency of the fan and drive assembly is 65 %.
4. The efficiency of the fan motor is 85%.
5. There are three steam coils with 1 row and 14 fins per inch. The pressure drop across each coil is 0.75 inches of water.
6. The exhaust system operates 24 hours per day, 260 days per year (6240 hrs/yr).

Current Energy Consumption:

$$Bhp = \text{Motor hp} \div 1.2 = 450\ hp \div 1.2 = 375\ Bhp$$

$$\text{Power} = \frac{Bhp \times 0.746 \frac{kw}{hp}}{\text{Motor Eff.}} = \frac{375 \times 0.746}{0.85} = 329\ kw$$

$$\text{Annual energy use} = 329\ kw \times 6240 \frac{hrs}{yr} = \underline{2,052,960\ kwh/yr}$$

$$\text{Annual energy use} = 2,052.96 \frac{Mwh}{yr} \times 3.413 \frac{MBtu}{Mwh} = \underline{7007\ MBtu/yr}$$

$$\text{Annual energy cost} = 2,052,960 \frac{kwh}{yr} \times 0.03026 \$/kwh = \underline{\$62,123/yr}$$

Additional Energy Consumption:

There is no additional energy consumption required by this ECO.

Energy Savings:

$$\text{Exhaust CFM} = \frac{\text{Bhp} \times \text{Fan.Eff.} \times 6350}{\text{Total Pressure}}$$

$$\text{CFM} = \frac{375\,\text{hp} \times 0.65 \times 6350}{20\,\text{in } H_2O} = 77{,}390 \frac{\text{cu.Ft.}}{\text{min}}$$

The reduction in total pressure by removing the steam coils would be:

$$TP_r = 0.75\,\text{in.}H_2O/\text{coil} \times 3\,\text{coils} = 2.25\,\text{in.}H_2O$$

The reduction in fan horsepower required is:

$$HP_r = \frac{CFM * TP_r}{\text{Fan.Eff.} \times 6350} = \frac{77390 \times 2.25}{0.65 \times 6350} = 42\,\text{hp}$$

$$\text{Power} = \frac{\text{hp} \times 0.746}{\text{Motor Eff.}} = \frac{42 \times 0.746}{0.85} = 37\,\text{Kw}$$

Energy Savings = 2 bldgs $\times$ 37 $\frac{\text{kw}}{\text{bldg.}}$ $\times$ 6240 hr/yr = **461,760 Kwh/yr**

Energy Savings = 461.76 $\frac{\text{Mwh}}{\text{yr}} \times \frac{3.413\,\text{MBtu}}{\text{Mwh}}$ = **1576 MBtu/yr**

Annual cost savings = 461,760 $\frac{\text{Kwh}}{\text{yr}} \times 0.03026\,\$/\text{Kwh}$ = **$13,973/yr**

ECO Costs:

Cost for removing steam coils, replacing ductwork and adjusting fan drive = $16,997

Refer to Construction Cost Estimate sheet for detailed itemization of costs.

Simple Payback:

ECO Payback = Cost ÷ Savings

Payback = $16,997 ÷ $13,973/yr = 1.2 years

CONSTRUCTION COST ESTIMATE	DATE PREPARED 5/21/90	SHEET 4 OF

PROJECT: ENERGY ENGINEERING ANALYSIS

LOCATION: RADFORD ARMY AMMUNITION PLANT

ARCHITECT ENGINEER: REYNOLDS, SMITH AND HILLS A.E.P., INC.

BASIS FOR ESTIMATE
- [x] CODE A (No design completed)
- [ ] CODE B (Preliminary design)
- [ ] CODE C (Final design)
- [ ] OTHER (Specify)

DRAWING NO.: NA | ESTIMATOR: W. T. Todd | CHECKED BY: ~~RH~~

Remove Steam Coils SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
Duct Demolition, 72"	30	LF	2.70	81.00	—	—	81.00
Coil Removal, 500 lb ea	1.5	Ton	395	592.50	—	—	592.50
Duct, 72" stainless steel	30	LF	31	930.00	63	1890.00	2820.00
Duct insulation, 1½", 1½ lb	565	SF	1.07	604.55	0.52	293.80	898.35
Duct ins. jacket, Gal. steel	30	LF	22.95	688.50	28.52	855.60	1544.10
Adjust fan, balance air	1	EA	150	150.00	25	25.00	175.00
Subtotal				3046.05		3064.40	6110.45
Location Adjustments			0.683	(965.60)	1.002	6.13	(959.47)
Sales Tax					4.5%	137.62	137.62
FICA / Insurance			20%	416.09			416.09
Subtotal							5704.69
Overhead	15%						855.70
Profit	10%						656.04
Performance Bond	1%						72.16
Contingency	10%						728.86
RAAP Support	6%						481.05
Construction Cost	(for each building)						8498.50
Construction Cost	(For two buildings)						$16,997.00

Source:
Means Mechanical Cost Data, 1989, Bare Costs

* U.S. GOVERNMENT PRINTING OFFICE : 1990 O—816146

HUNTER

Telephone Call Confirmation

Project No. 2900379 000

Local _____ (L.D.) _____ (Placed) _____ Rec'd. _____ Date 5/17/90

Bill Todd Conversed With Everett Grubb / H. Hill

Of RAAP Maintenance Regarding Activated Carbon Sol. Recovery

Mr. Grubb was not available so I spoke with an assistant about heat recovery potential.

* Solvent condenser uses filtered water (not chilled water) at 40 lbs pressure.

* Steam coils are not used. The steam valves to these coils have been shut off.

Distribution:

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INCORPORATED

SUBJECT Remove Steam Coils
DESIGNER W. T. Todd
CHECKER

AEP NO
SHEET OF
DATE
DATE

Cost Estimate Back Up

Means Mech
Page

12 Coil removal 500 lb each $395/ton

12 Duct removal 72" wide $2.70/LF

231 New Duct - S. Steel 72" round

$mat = \left(\frac{35 - 31.5}{4}\right) \times 32 + 35 = \$63.00/LF$

$Lab = \left(\frac{15.4 - 13.45}{4}\right) \times 32 + 15.40 = \$31.00/LF$

171 Duct insulation

$2\pi r l = 2 \times 3.14 \times 3Ft \times 30Ft = 565 sq.ft.$

229 insulation jacket 74" ø

gal. steel

$mat = \left(\frac{13.95 - 11.65}{6}\right) \times 38 + 13.95 = \$28.52/LF$

$Lab = \left(\frac{13.45 - 11.95}{6}\right) \times 38 \times 13.45 = \$22.95/LF$

256 Fan adjustment (air balance) $175 each

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INCORPORATED

SUBJECT
AEP NO
SHEET OF
DESIGNER D. Todd
DATE
CHECKER
DATE

COST ESTIMATE BACKUP

Means Mech
Page

12 Coil removal 500 lb each $395/ton

12 Duct removal 72" wide $2.70/LF

231 New Duct - S. steel 72" round

$mat = \left(\frac{35 - 31.5}{4}\right) \times 32 + 35 = \$63.00/LF$

$Lab = \left(\frac{15.4 - 13.45}{4}\right) \times 32 + 15.40 = \$31.00/LF$

171 Duct insulation

$2\pi r l = 2 \times 3.14 \times 3Ft \times 30Ft = 565$ sq.ft.

429 insulation jacket 74" ø

gal. steel

$mat = \left(\frac{13.95 - 11.65}{6}\right) \times 38 + 13.95 = \$28.52/LF$

$Lab = \left(\frac{13.45 - 11.95}{6}\right) \times 38 \times 13.45 = \$22.95/LF$

256 Fan adjustment (air balance) $175 each

DOCUMENTATION FOR PRODUCTIVITY CAPITAL INVESTMENT PROGRAMS
For use of this form, see AR 5-4; the proponent agency is OCA.

1. PROJECT NO.

REQUIREMENT CONTROL SYMBOL DD-M(R) 1561

2. TO: CDR, AMC (AMCRM-MP)
5001 Eisenhower Avenue
Alexandria, VA 22333-0001

3. THRU:

4. FROM: CDR, AMCCOM
Attn: AMSMC-MGP-P (R)
Rock Island, IL 61299-6000

5. DOD COMP NAME: Army

6. DOD COMP CODE: A

7. COMMAND CODE: W73QKK

8. DATE:

9. PROJECT TITLE: Replace Exterior Incandescents with Fluorescents (ECO GP-N-3)

10. TYPE OF PROJECT (Check one): [X] OPIP [ ] OSD PIF [ ] PECIP

11. AMORTIZATION YEARS/MONTHS: $ 21,485 (Project Cost) + 15,770 (Average Annual Savings) X 12 (No. Mos) = 1.4 (years) or -- (months) (amortization)

12. FUNCTIONAL AREA WHERE SAVINGS WILL OCCUR: 024

13. ECONOMIC LIFE:

14. EXPECTED OPERATIONAL DATE:

15. SUBMITTING UNIT(S): Administrative Contracting Office
Radford Army Ammunition Pt.
Radford, VA 24141

16. UNIT ID CODE: WOLLAA

17. PROJECT DESCRIPTION: Replace exterior incandescent floodlights with 13 watt compact fluorescent screw-ins.

18. DETAILED JUSTIFICATION: Existing incandescent flood lights have an efficacy of about 15 lumens/watt. Fluorescents offer about 50 lumens/watt. This is recommended in areas where a 25-percent reduction in lighting level is acceptable and the fixtures are non-explosion proof type.

19. SAVINGS DISPOSITION: Savings are used to reduce energy costs.

20. OTHER REMARKS (Continue on page 5, if more space is needed)

1 August 1982

21a. SUMMARY OF DOLLAR SAVINGS
(ROUND OFF TO THE NEAREST DOLLAR)

Attach computation sheet identifying the method and source of data for savings

SAVINGS BREAKOUT	PRESENT METHOD	PROPOSED METHOD 1ST YR	PROPOSED METHOD 2D YR	PROPOSED METHOD 3D YR	PROPOSED METHOD 4TH YR	DIFFERENCE/SAVINGS 1ST YR	DIFFERENCE/SAVINGS 2D YR	DIFFERENCE/SAVINGS 3D YR	DIFFERENCE/SAVINGS 4TH YR
SALARY/LABOR/ OVERTIME									
MATERIAL/ SUPPLIES	6,302	1,765	1,765	1,765	1,765	4,537	4,537	4,537	4,537
UTILITIES									
MAINTENANCE/ REPAIR	2,448	297	297	297	297	6,688	6,688	6,688	6,688
TRANSPORTATION									
LEASE COSTS									
SALVAGE/ TURN-IN									
ENERGY (Identify) Electricity	10,168	1,085	1,085	1,085	1,085	9,083	9,083	9,083	9,083
CONTRACT COSTS									
OTHER (Identify) _____									
TOTALS	18,918	3,147	3,147	3,147	3,147	15,770	15,770	15,770	15,770

b. PRIORITIZATION

(1) INTERNAL RATE OF RETURN (IRR)

Divide estimated project cost 21,485 by average annual savings 15,770 = 1.36 factor.

Based on factor and number of years economic life of the project, select the IRR from Table H-3, App H, Ch. 5, AR 5-4 = 11.7 % IRR.

(2) SAVINGS TO INVESTMENT RATIO (S/I)

Multiply annual savings 15,770 X discount factor 8.78 = 138,461 and divide by present value of investment (undiscounted) 21,485 = 6.4 S/I.

(Based on economic life 15 years, select discount factor from Table H-4, App H, Ch. 5, AR 5-4.

(3) RATE OF INVESTMENT PER MANPOWER SPACE (RIMS) NA

Divide estimated project cost _____ by number of manpower space savings _____ = _____ RIMS.

(Manpower requirements cannot be used in this computation.)

22. COST FOR PROJECT TO BECOME OPERATIONAL

EQUIPMENT TYPE a	PROPOSED SOURCE OF PROCUREMENT b	UNIT PRICE c	QUANTITY d	TOTAL COST e	APPROPRIATION, BUDGET ACTIVITY OR PROGRAM ELEMENT f	FY FUNDS REQUIRED g
(1) 13 Watt PL Compact Fluorescents		59.85	359	21,485		
(2)						
(3)						
(4)						
(5)						
(6) TRANSPORTATION (Equipment delivery)						
(7) EQUIPMENT MODIFICATION[1]						
(8) EQUIPMENT INSTALLATION						
(9) MAINTENANCE CONTRACT[2]						
(10) FACILITIES MODIFICATION[3]						
(11) TRAINING						
(12) OTHER (Specify):						
(13) TOTAL REQUIRED FOR PROJECT TO BECOME OPERATIONAL[4]				21,485		
(14) TOTAL AMOUNT OF FUNDING REQUESTED IN THIS PROPOSAL				21,485		
(15) TOTAL AMOUNT OF FUNDING REQUIRED FROM OTHER SOURCE[5]				0		
(16) TOTAL (Sum of (14) + (15) above)				21,485		

[1] *Not to exceed 10% of equipment cost for QRIP projects.*

[2] *Applicable to OPA QRIP provided cost is included in packaged deal involving one bill for the equipment and initial maintenance.*

[3] *Normally not OPA funded.*

[4] *Used to compute amortization in Item 11.*

[5] *Specify source to include certification that funds are available, if financed from the regular budget:*

23. SUMMARY OF SAVINGS *(MANPOWER AND DOLLARS)*

ITEMS	SAVINGS			REAPPLICATION OF SAVINGS					
	NO. MPR OR MHR	TYPE PERS[6]	DOLLARS	PROGRAM ELEMENT		TDA PARA AND LINE		FUNCTION CODE	
a	b	c	d	e. FROM	f. TO	g. FROM	h. TO	i. FROM	j. TO
(1) REQUIREMENTS AND AUTHORIZATIONS ELIMINATED									
(2) REQUIREMENTS ONLY ELIMINATED									
(3) BORROWED MILITARY MANPOWER RELEASED									
(4) OVERHIRES OR TEMPORARIES TERMINATED									
(5) HOURS OVERTIME ELIMINATED									
(6) MANHOURS SAVED FROM MULTIPLE POSITIONS[7]			2,140						
(7) OTHER DOLLAR SAVINGS *(Excluding Manpower)*, e.g., CONTRACT COSTS & UTILITIES			13,630						
(8)									
(9)									
(10)									
(11) TOTAL DOLLAR SAVINGS			15,770						

[6] *(1) US Graded*
(2) US Wage Board
(3) DHFN
(4) IHFN
(5) Officer
(6) WO
(7) Enlisted

[7] *Reflect specific duties being performed with additional manhours available (equivalent manyears)*

24. REGULATORY APPROVAL/COORDINATION

a. INVESTMENT STATEMENT

This proposal has been reviewed and it cannot be implemented with existing equipment or facilities. This investment is in accordance with established investment planning. The project complies with public laws, OSD policies and regulations, and all other regulatory constraints.

(Cite regulatory approvals, e.g., TAGO Control No.) (Ex. New Start, TAGO Approval, etc.)

b. OTHER COORDINATION *(Functional Coordination at local level, e.g., Fac Eng, Log, Pers, etc.)*

25. SUBMITTED BY *(Typed name, grade and title of Subordinate Command/Agency or Project Initiator)*	SIGNATURE	DATE *(YYMMDD)* AUTOVON
26. APPROVAL RECOMMENDED BY *(MACOM/Agency)*	SIGNATURE	DATE *(YYMMDD)* AUTOVON

FOR USE BY HQDA ON OSD PIF PROJECTS ONLY

27. APPROVED BY	SIGNATURE	DATE *(YYMMDD)* AUTOVON

28. OTHER REMARKS *(Cont'd)*

Figure H–1 Documentation for Productivity Capital Investment Program (DA Form 5108–R)—Continued.

REYNOLDS, SMITH AND HILLS
ARCHITECTS • ENGINEERS • PLANNERS
INCORPORATED

SUBJECT RAAP Lighting Projects AEP NO 290 0379 000
SHEET 1 OF 10
DESIGNER T. Todd DATE
CHECKER DATE

GP-N-3 REPLACE EXTERIOR INCANDESCENTS WITH COMPACT FLUORESCENT FLOODS

Many buildings at RAAP are lit with inefficient incandescent lighting. This ECO analyzes the replacement of exterior incand. floods with 13 WPL compact fluorescent flood retrofits which screw into the incandescent sockets. This type of project is suitable for non-explosion proof fixtures in areas where a 20-30% reduction in light level is acceptable. Costs and savings were calculated on a per unit basis as shown on page 2. Only areas operating 3 shifts/day, 5 days/wk were considered. A list of buildings with incandescent lighting was compiled from the building survey data (page 3). It is assumed that 50% of the exterior fixtures on this list are non-explosion proof floods.

Number of fixtures = 0.5 (717) = 359

Energy savings = $836 \frac{\text{kwh}}{\text{yr}} \times 0.003413 \frac{\text{MBtu}}{\text{kwh}} \times 359 = 1024 \frac{\text{MBtu}}{\text{yr}}$

Energy cost savings = $\frac{\$25.30}{\text{yr-fixture}} \times 359 \text{ fixtures} = \$9083/\text{yr}$

Matl & Labor cost savings = $\frac{\$18.63}{\text{yr-fixt.}} \times 359 = \$6688/\text{yr}$

Total cost savings = 9083 + 6688 = $15,771/yr

Project cost = $66.73/fixture x 359 = $23,956

(Construction cost = 23,956 / 1.115 = $21,485)

Simple Payback = $23,956 / ($15,771/yr) = 1.5 yr

REYNOLDS, SMITH AND HILLS
ARCHITECTS • ENGINEERS • PLANNERS
INCORPORATED

SUBJECT RAAP Lighting Projects Screening Calcs. AEP NO 290 0379 000
DESIGNER T. Todd SHEET 2 OF 10
CHECKER DATE DATE

GP-N-3 Reduce light levels - limited applications to replace exterior 150 W incandescents with 13 W PL fluorescent screw-in retrofits

- Assume original light levels can be reduced by 20-30%
- Assume non-explosion proof application

$$\text{Energy savings} = (150\ W - 16\ W) \times 24\ \frac{hr}{day} \times 260\ \frac{days}{yr} = 836\ \frac{kwh}{yr}$$

$$\text{Energy cost savings} = 836\ \frac{kwh}{yr} \times \frac{\$0.03026}{kwh} = \frac{\$25.30}{yr}$$

$$\text{Labor \& mat'l cost savings} = \left(\frac{\text{Incand. cost}}{750\ hr} - \frac{\text{Fluor. cost}}{10{,}000\ hr}\right) \times 6240\ \frac{hr}{yr}$$

$$= \left[\frac{(\$2.11\ \text{mat'l} + \$1.20\ \text{labor} \times 0.683)}{750\ hr} - \frac{(\$7.88\ \text{mat'l} + \$1.95\ \text{labor} \times 0.683)}{10{,}000\ hr}\right] \times 6240\ \frac{hr}{yr}$$

$$= \frac{\$18.63}{yr}$$

$$\text{Total cost savings} = \frac{\$25.30}{yr} + \frac{\$18.63}{yr} = \frac{\$43.93}{yr}$$

Mat'l cost = $37.32 for fixture price including lamp (1989 vendor info. Reflect-A-Star flood)

Labor cost = $1.20 × 1.2 × 0.683 (cost of replacing incand. + 20%)

Project cost = [(1.045 × $37.32) + (1.2 × $0.98)] × 1.66 = $66.73

Simple payback = $\frac{\$66.73}{\$43.93/yr}$ = 1.5 yr < 10 yr ⇒ recommended

RS&H®

SUBJECT _____ AEP NO _____

SHEET _____ OF _____

DESIGNER PFH DATE 10/29/90

CHECKER _____ DATE _____

QRIP Calc.'s

Current energy costs:

$$\frac{150\,W}{lamp} \times \frac{24\,hr}{da} \times 260\,da \div 1000 * 359\,lamps * \$0.3026/kwh =$$

$$= \$10,168/yr.$$

Current material & labor costs:

$$\frac{cost/lamp}{750\,hr} * 359 * \frac{6240\,hrs}{yr}$$

$$\frac{2.11 + 1.2 \times 0.68}{750\,hr} * 359 * 6240 = \$8750/yr$$

New energy costs:

$$16 * 24 * 260 \div 1000 * 359 * 0.03026 = \$1085/yr.$$

New matl & labor costs

$$\frac{7.83 + 1.95 \times 1.68}{10,000} * 359 * 6240 = \$2062/yr$$

Labor savings

$$\left(\frac{1.2 \times 0.68}{750} - \frac{1.95 \times 0.68}{10,000}\right) * 359 * 6240 = \$2140/yr$$

For fluorescents, replace ~~both~~ lamp only.

RS&H®

SUBJECT _____ AEP NO _____

SHEET _____ OF _____

DESIGNER _____ DATE _____

CHECKER _____ DATE _____

Current mat'l costs:

$\frac{2.11}{750} * 359 * 6240 = \$6302/yr$

New mat'l costs:

$\frac{7.88}{10,000} * 359 * 6240 = \$1765/yr$

Current labor:

$8750 - 6302 = \$2448/yr$

New labor:

$2062 - 1765 = \$297/yr$

Radford Army Ammunition Plant
List of Buildings with Incandescent Lighting

Bldg No	Name/Process	Location	Similar	Fixtures/Bldg.	Total Fixtures
1000 -00	Cotton Linter Warehouse	NC, A&B-Line	1	17	17
1606 -00	Open Tank Air Dry	Sol. Recovery, A-Line	10	20	200
1611 -00	Solvent Recovery House	Sol. Recovery, B-Line	27	12	324
3513 -00	C-1 Press & Cutting House	Green, C-Line	3	20	60
4912 -27	SG Curing Hse.- Carpet Rolls	Cast Prop. (Rocket)	10	5	50
4924 -06	Machine and Saw House	Cast Prop. (Rocket)	1	6	6
7106 -04	Dry House #4 (Cure Grain)	1st R P	7	8	56
9334 -15	Blender House	4th Rolled Powder	1	4	4
TOTAL FOR EXTERIOR FIXTURES					717
420 -02	Acid Waste Disposal (C-Line)	Waste Acid	1	8	8
2019 -00	Boiling Tub House	NC, B-Line	3	50	150
2022 -00	Beater House	NC, B-Line	3	40	120
2024 -00	Poacher & Blending House	NC, B-Line	3	30	90
3513 -00	C-1 Press & Cutting House	Green, C-Line	3	50	150
4912 -40	Forced Air Dry House	Pilot B	21	10	210
4912 -11	LG Mold Loading House	Cast Prop. (Rocket)	2	6	12
4912 -03	MK 43 Sawing and Inhibiting	Cast Prop. (Rocket)	1	4	4
4915 -00	Small Grain Mold Assembly	Cast Prop. (Rocket)	1	7	7
4921 -00	Inspect/Clean NG Tanks *	Cast Prop. (Rocket)	1	21	21
4951 -02	TOW Launch Saw House	Pilot B	1	8	8
5008 -01	15 Inch Press House	Pilot A	3	2	6
6304 -00	Paste Blending House	1st R P	1	20	20
7113 -00	Roll House (Rolled Powder)	1st R P (F-Line)	1	130	130
9310 -02	Rolled Powder Building	4th Rolled Powder	2	300	600
TOTAL FOR INTERIOR FIXTURES					1536

CONSTRUCTION COST ESTIMATE	DATE PREPARED 6/96	SHEET 4 OF 10

PROJECT: ENERGY ENGINEERING ANALYSIS

LOCATION: RADFORD ARMY AMMUNITION PLANT

ARCHITECT ENGINEER: REYNOLDS, SMITH AND HILLS A.E.P., INC.

BASIS FOR ESTIMATE
- [x] CODE A (No design completed)
- [ ] CODE B (Preliminary design)
- [ ] CODE C (Final design)
- [ ] OTHER (Specify) _____

DRAWING NO.: GP-N-3

ESTIMATOR: T. Todd

CHECKED BY:

Increase to fluor. floods SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
Replace incandescent	359	fixt.	0.98	352	37.32	13398	13750
floods with 13W PL							
fluorescent floods							
Sales Tax	4.5%					603	603
FICA / Insurance	20.0%			70			70
Subtotal				422		14001	14423
Overhead	15.0%						2163
Profit	10.0%						1659
Performance Bond	1.0%						182
Hercules Support	6.0%						1106
Contingency	10.0%						1953
Construction Cost							21486

INCANDESCENT LAMPS

GENERAL ELECTRIC LAMPS


A-21


G-16½


R-40


T-10 INCANDESCENT


PAR-38

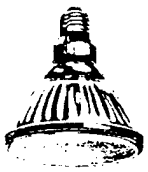

G-40


R-30

Bulb	Base	Prod. Code	Lamp Ordering Code	Volts	Std. Pkg. Qty.	Filament Desgn	MOL (In.)	LCL (In.)	Rated Avg. Life Hours	App. Init Lum.	DESCRIPTION See Incandescent footnotes pg. 46
100 WATTS (Continued)											
G-40	Medium	39627	100G40/W	120	24	CC-6	6 15/16	--	2500	1280	Pearl (White)--Globe
G-40	Medium	49781	100G40/W 6PK	120	6	CC-6	6 15/16	--	2500	1280	Pearl (White)--Globe. Moonglow
G-40	Medium	13046	100G40/W/L	120	24	CC-6	6 15/16	--	4000	1220	Pearl (White)--Globe
A-23	Medium	18599	100A/B	120	120	CC-6	5 15/16	--	750	--	*Blue
A-23	Medium	18610	100A/G	120	120	CC-6	5 15/16	--	750	--	*Green
A-23	Medium	18594	100A/O	120	120	CC-6	5 15/16	--	750	--	*Orange
A-23	Medium	18632	100A/R	120	120	CC-6	5 15/16	--	750	--	*Red
A-21	Med.(BB)	18363	100A21/TS	120	120	C-9	4 3/8	2 7/16	3000	1280	Clear--Traffic Signal. Rated Watts: 98. BDTH (78)
A-21	Med.(BB)	18365	100A21/TS	130	120	C-9	4 3/8	2 7/16	3000	1280	" "
A-21	Med.(BB)	18386	100A21/SP	120	120	C-5	4 3/8	3	200	1340	Clear--Spotlight
A-21	Med.(BB)	17860	100A21/4SP	120	120	C-5	4 3/8	3	200	--	Light I.F.--Medical Spotlight
A-23	Medium	18449	100A23	120	120	CC-6	5 15/16	4 7/16	750	--	Inside Frost
A-23	Med.(BB)	18542	100A23/20	120	120	CC-6	5 15/16	4 7/16	1000	--	Clear--Commercial Oven
G-16½	S.C.Bay.	18717	100G16½/29SC	120	60	CC-13	3	1 3/8	200	1660	Clear--Spotlight. BDTH (7,86,99)
G-16½	D.C.Bay.	18721	100G16½/29DC	120	60	CC-13	3	1 3/8	200	1660	" "
G-16½	D.C.Bay.	18723	100G16½/29DC	130	60	CC-13	3	1 3/8	200	1660	" "
R-40	Medium	18871	**100R/FL	120	24	CC-6	6 5/16	--	2000	1190	Reflector Flood. I.F. (4,35,56)
R-40	Medium	18873	**100R/FL	130	24	CC-6	6 5/16	--	2000	1190	" "
R-40	Medium	18876	100R/SP	120	24	CC-6	6 5/16	--	2000	1190	Refl. Spot--Light I.F. (4,35,56)
T-8½	Medium	18898	100T8½/9	120	24	CC-13	5 3/8	3	50	1920	Microscope--ANSI: EDR (22,86,99)
T-10 (HRG)	D.C.Med. Ring	18905	100T10/7	6	24	C-6	5½	2 3/16	50	--	††Contour Projector ANSI: CPS (1,86,99)
T-10 (HRG)	Med.Pref	18907	100T10P	6	24	C-6	5 1/4	2 3/16	50	--	††Contour Projector ANSI: CPT (1,86,99)
A-23	Medium	18512	100A23	12	120	C-6	5 15/16	4 7/16	1000	--	Inside Frost (53)
PAR-38 (HRG)	Med.Side Prong	18822	100PAR38/FL	12	12	C-6	4 5/16	--	1000	1400	PAR--Mine Flood (58)
PAR-38 (HRG)	Med.Skir (BB)	18824	100PAR38/2FL	12	12	C-6	5 5/16	--	1000	1400	PAR--Flood (14,56,96)
PAR-64 (HRG)	Scr.Term	>39394	100PAR64	6	12	C-6	4	--	50	--	Ceilometer--Very Narrow Spot. Filament shielded
R-30 (HRG)	Med.(BB)	>39503	100R30/CL	12	24	C-6	5 3/8	--	2000	1200	Reflector Flood--Clear (4,14,53)
T-8	S.C.Bay.	18881	100T8/1SC	20	24	CC-6	3	2 3/16	50	--	Clear-Contour Map ANSI: BZA (8,31,61,86,94)●
A-21	Medium	18290	100A/RS	30	120	C-9	5 1/4	3 13/16	1000	--	I.F.--Rough Serv.
A-21	Med.(BB)	17845	100A21/3	32	120	C-5	4 3/8	3	500	1610	Clear--Locomotive Headlight (13)
A-23	Medium	17904	100A	34	120	C-9	5 15/16	4 7/16	1000	2160	I.F.--Train
A-23	Med.(BB)	>17906	100A/BB	34	120	C-9	5 15/16	4 7/16	1000	2160	" "
PAR-46 (HRG)	Scr.Term (BB)	34465	100PAR46	60	12	CC-2V	3 3/4	--	800	--	Mine Locomotive Headlight (71)
A-21	Medium	17976	100A	230	120	C-7A	5 1/4	3 13/16	1000	1280	Inside Frost
A-21	Medium	17983	100A	250	120	C-7A	5 1/4	3 13/16	1000	1280	" "
A-21	Med.(BB)	18346	100A/99	230-250	120	C-7A	5 1/4	3 13/16	2500	--	I.F.--Ext. Serv.
A-21	Medium	18334	100A/RS	250	120	C-17	5 1/4	3 13/16	1000	960	I.F.--Rough Serv.

> New product listing.
* In "base up" use, heat eventually may deteriorate paper-lined or plastic sockets.
● Source W x H: 4.5 x 3.0mm. Burn base up.
†† Filament offset .100" +-.030" from base axis.
** FOR ENERGY SAVING in deep down lights consider the 75ER30 lamp shown on page 23 . The resulting cost savings are shown on page 5.

NCANDESCENT LAMPS



PAR-38

INCANDESCENT

R-40

ulb	Base	Prod. Code	Lamp Ordering Code	Volts	Std. Pkg. Qty.	Fila-ment Desgn	MOL (In.)	LCL (In.)	Rated Avg. Life Hours	App. Init Lum.	DESCRIPTION See Incandescent footnotes pg. 46
150 WATTS (Continued)											
AR-46 HRG)	Med.Side Prong	41966	150PAR46/3NSP	125	12	CC-13	4	--	2000	1500	Narrow Spot (11,56,58,96)
AR-46 HRG)	Med.Side Prong	41968	150PAR46/3MFL	125	12	CC-13	4	--	2000	1500	Medium Flood (11,56,58,96)
AR-46 HRG)	Scr.Term (BB)	19517	150PAR46	125	12	C-13	3¾	--	1000	--	Mine Locomotive Headlight
AR-46 HRG)	3-Prong	>35327	150PAR46/TS	115	12	CC-6	4	--	6000	--	Traffic Signal Stippled Reflector Tapioca lens cover (2)
AR-38 HRG)	Med.Side Prong	44933	150PAR/3VWFL	125	12	C-13	4 5/16	--	2000	--	† Mine--Wide Flood (56,58,96)
AR-38 HRG)	Med.Side Prong	19497	150PAR/4	125	12	C-13	4 5/16	--	2000	--	† Mine--Spot (56,58,96)
AR-38 HRG)	Med.Skir (BB)	19509	150PAR/5	125	12	C-13	5 5/16	--	2000	--	† Mine--Spot (14,56,96)
AR-46 HRG)	Scr.Term (BB)	19518	150PAR46/3	175	12	C-13	3¾	--	800	--	Mine. Locomotive Headlight (71)
-40	Medium	19797	**150R/FL	120	24	CC-6	6 5/16	--	2000	1900	Reflector Flood--ANSI: DWC (4,14,35,56)
-40	Medium	>16445	150R/FL-1	6PK 120	30	CC-6	6 5/16	--	2000	1900	Standard Reflector Flood (4,14,35,56)
-40	Medium	19799	**150R/FL	130	24	CC-6	6 5/16	--	2000	1900	Reflector Flood (4,14,35,56)
-40	Med.(BB)	14715	150R/FL/CVG	130	24	CC-6	6 5/16	--	2000	--	>>Refl. Flood--COV-R-GUARD™ (4,35,56,83)
-40	Medium	19783	150R/SP	120	24	CC-6	6 5/16	--	2000	1900	Refl. Spot--Light I.F. (4,14,35,56)
-40	Medium	>16446	150R/SP-1	6PK 120	30	CC-6	6 5/16	--	2000	1900	Standard Reflector Spot (4,14,35,56)
-40	Medium	19785	150R/SP	130	24	CC-6	6 5/16	--	2000	1900	Reflector Spot--Light I.F. (4,14,35,56)
-40	Medium	19844	150R/A	120	24	CC-6	6 5/16	--	2000	--	Reflector--Amber (14,35,36)
-40	Medium	19823	150R/B	120	24	CC-6	6 5/16	--	2000	--	Reflector--Blue (14,35,36)
-40	Medium	19827	150R/BW	120	24	CC-6	6 5/16	--	2000	--	Reflector--Blue-White (14,35,36)
-40	Medium	19831	150R/G	120	24	CC-6	6 5/16	--	2000	--	Reflector--Green (14,35,36)
-40	Medium	19835	150R/PK	120	24	CC-6	6 5/16	--	2000	--	Reflector--Pink (14,35,36)
-40	Medium	19841	150R/R	120	24	CC-6	6 5/16	--	2000	--	Reflector--Red (14,35,36)
-40	Medium	19851	150R/Y	120	24	CC-6	6 5/16	--	2000	--	Reflector--Yellow (14,35,36)
-40	Med.(BB)	41627	150R40/PL	6PK 120	24	CC-6	6 5/16	--	2000	--	Reflector Plant Light--"Gro and Sho" (4,14,56)
-40	Medium	44674	150R40/TB	120	24	CC-6	6 5/16	--	2000	--	Jewelry Spot Reflector Transparent Daylight Blue (4,14,35,56,76)
-40	Medium	44675	150R40/TB	130	24	CC-6	6 5/16	--	2000	--	Jewelry Spot Reflector Transparent Daylight Blue (4,14,35,56,76)
-25	Med.(BB)	19372	150P25/10	120	60	C-5	4¾	3	200	2100	Light I.F.--Spotlight. Hard glass button

New product listing.
-> Teflon® Coated. Teflon is a registered trademark of Dupont.
Operating position horizontal with locating lug up or down, and with lamp supported by bulb rim.
** FOR ENERGY SAVING in deep down lights consider the 75ER30 lamp shown on page 23 . The resulting savings are shown on page 5.

166 100 | Lighting

			CREW	DAILY OUTPUT	MAN-HOURS	UNIT	BARE COSTS MAT.	BARE COSTS LABOR	BARE COSTS EQUIP.	BARE COSTS TOTAL	TOTAL INCL O&P	
140	1600	90 watt	1 Elec	.30	26.670	C	5,140	645		5,785	6,600	140
	1650	135 watt		.20	40		6,905	970		7,875	9,025	
	1700	180 watt		.20	40		7,308	970		8,278	9,475	
	1750	Quartz line, clear, 500 watt		1.10	7.270		1,872	175		2,047	2,325	
	1760	1500 watt		.20	40		3,427	970		4,397	5,200	
	1800	Incandescent, interior, A21, 100 watt		1.60	5		173	120		293	370	
	1900	A21, 150 watt		1.60	5		211	120		331	410	
	2000	A23, 200 watt		1.60	5		227	120		347	430	
	2200	PS 30, 300 watt		1.60	5		330	120		450	540	
	2210	PS 35, 500 watt		1.60	5		576	120		696	810	
	2230	PS 52, 1000 watt		1.30	6.150		1,525	150		1,675	1,900	
	2240	PS 52, 1500 watt		1.30	6.150		2,382	150		2,532	2,850	
	2300	R30, 75 watt		1.30	6.150		375	150		525	630	
	2400	R40, 150 watt		1.30	6.150		408	150		558	670	
	2500	Exterior, PAR 38, 75 watt		1.30	6.150		566	150		716	840	
	2600	PAR 38, 150 watt		1.30	6.150		525	150		675	795	
	2700	PAR 46, 200 watt		1.10	7.270		1,928	175		2,103	2,375	
	2800	PAR 56, 300 watt		1.10	7.270		2,193	175		2,368	2,675	
	3000	Guards, fluorescent lamp, 4' long		1	8		375	195		570	695	
	3200	8' long		.90	8.890		535	215		750	905	
145	0010	RESIDENTIAL FIXTURES										145
	0400	Fluorescent, interior, surface, circline, 32 watt & 40 watt	1 Elec	20	.400	Ea.	48	9.70		57.70	67	
	0500	2' x 2', two U 40 watt		8	1		66	24		90	110	
	0700	Shallow under cabinet, two 20 watt		16	.500		45	12.15		57.15	67	
	0900	Wall mounted, 4'L, one 40 watt, with baffle		10	.800		41	19.40		60.40	74	
	2000	Incandescent, exterior lantern, wall mounted, 60 watt		16	.500		36	12.15		48.15	57	
	2100	Post light, 150W, with 7' post		4	2		104	49		153	185	
	2500	Lamp holder, weatherproof with 150W PAR		16	.500		16	12.15		28.15	35	
	2550	With reflector and guard		12	.667		31	16.15		47.15	58	
	2600	Interior pendent, globe with shade, 150 watt		20	.400		78	9.70		87.70	100	
150	0010	TRACK LIGHTING										150
	0080	Track, 1 circuit, 4' section	1 Elec	6.70	1.190	Ea.	33	29		62	79	
	0100	8' section		5.30	1.510		48	37		85	105	
	0200	12' section		4.40	1.820		81	44		125	155	
	0300	3 circuits, 4' section		6.70	1.190		36	29		65	82	
	0400	8' section		5.30	1.510		48	37		85	105	
	0500	12' section		4.40	1.820		88	44		132	160	
	1000	Feed kit, surface mounting		16	.500		12	12.15		24.15	31	
	1100	End cover		24	.333		1.98	8.10		10.08	14.05	
	1200	Feed kit, stem mounting, 1 circuit		16	.500		16	12.15		28.15	35	
	1300	3 circuit		16	.500		16	12.15		28.15	35	
	2000	Electrical joiner for continuous runs, 1 circuit		32	.250		6.55	6.05		12.60	16.10	
	2100	3 circuit		32	.250		12.10	6.05		18.15	22	
	2200	Fixtures, spotlight, 150 PAR		16	.500		47	12.15		59.15	70	
	3000	Wall washer, 250 watt tungsten halogen		16	.500		101	12.15		113.15	130	
	3100	Low voltage, 25/8 watt, 1 circuit		16	.500		102	12.15		114.15	130	
	3120	3 circuit		16	.500		109	12.15		121.15	140	

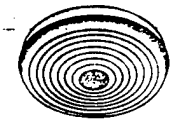
166 100 | Lighting

			CREW	DAILY OUTPUT	MAN-HOURS	UNIT	BARE COSTS MAT.	BARE COSTS LABOR	BARE COSTS EQUIP.	BARE COSTS TOTAL	TOTAL INCL O&P	
135	5100	175 watt metal halide	1 Elec	8	1	Ea.	479	24		503	565	135
	5110	250 watt metal halide		8	1		500	24		524	585	
	5120	150 watt high pressure sodium		8	1		535	24		559	625	
	5130	250 watt high pressure sodium		8	1		556	24		580	645	
	5140	72"H 18" sq., 400 watt metal halide		8	1		525	24		549	615	
	5150	250 watt high pressure sodium		8	1		556	24		580	645	
	5160	400 watt high pressure sodium		8	1		581	24		605	675	
	5190	Portable rectangle, 6" high 13.5" x 20"										
	5200	175 watt metal halide	1 Elec	12	.667	Ea.	293	16.15		309.15	345	
	5210	250 watt metal halide		12	.667		314	16.15		330.15	370	
	5220	150 watt high pressure sodium		12	.667		335	16.15		351.15	390	
	5230	250 watt high pressure sodium		12	.667		360	16.15		376.15	420	
	5240	8" high 18" x 24", 400 watt metal halide		12	.667		365	16.15		381.15	425	
	5250	250 watt high pressure sodium		12	.667		376	16.15		392.15	435	
	5260	400 watt high pressure sodium		12	.667		398	16.15		414.15	460	
	5270	Portable square, 15" high 13.5" sq., 175 watt metal halide		12	.667		324	16.15		340.15	380	
	5280	250 watt metal halide		12	.667		376	16.15		392.15	435	
	5290	150 watt high pressure sodium		12	.667		360	16.15		376.15	420	
	5300	250 watt high pressure sodium		12	.667		386	16.15		402.15	450	
	5400	Pendent 16" round/square, 175 watt metal halide		3.20	2.500		355	61		416	480	
	5410	250 watt metal halide		2.70	2.960		370	72		442	515	
	5420	400 watt metal halide		2.40	3.330		398	81		479	555	
	5430	150 watt high pressure sodium		3.20	2.500		398	61		459	525	
	5440	250 watt high pressure sodium		2.70	2.960		428	72		500	575	
	5450	400 watt high pressure sodium		2.40	3.330		454	81		535	620	
140	0010	LAMPS										140
	0080	Fluorescent, rapid start, cool white, 2' long, 20 watt	1 Elec	1	8	C	348	195		543	670	
	0100	4' long, 40 watt		.90	8.890		198	215		413	535	
	0120	3' long, 30 watt		.90	8.890		442	215		657	805	
	0150	U-40 watt		.80	10		874	245		1,119	1,325	
	0170	4' long, 35 watt energy saver		.90	8.890		270	215		485	615	
	0200	Slimline, 4' long, 40 watt		.90	8.890		618	215		833	995	
	0300	8' long, 75 watt		.80	10		577	245		822	990	
	0350	8' long, 60 watt energy saver		.80	10		603	245		848	1,025	
	0400	High output, 4' long, 60 watt		.90	8.890		750	215		965	1,150	
	0500	8' long, 110 watt		.80	10		775	245		1,020	1,200	
	0520	Very high output, 4' long, 110 watt		.90	8.890		1,285	215		1,500	1,725	
	0550	8' long, 215 watt		.70	11.430		1,285	275		1,560	1,825	
	0600	Mercury vapor, mogul base, deluxe white, 100 watt		.30	26.670		2,142	645		2,787	3,300	
	0650	175 watt		.30	26.670		1,663	645		2,308	2,775	
	0700	250 watt		.30	26.670		2,968	645		3,613	4,225	
	0800	400 watt		.30	26.670		2,340	645		2,985	3,525	
	0900	1000 watt		.20	40		5,100	970		6,070	7,025	
	1000	Metal halide, mogul base, 175 watt		.30	26.670		3,749	645		4,394	5,075	
	1100	250 watt		.30	26.670		4,712	645		5,357	6,125	
	1200	400 watt		.30	26.670		4,386	645		5,031	5,775	
	1300	1000 watt		.20	40		9,894	970		10,864	12,300	
	1320	1000 watt, 125,000 initial lumens		.20	40		9,960	970		10,930	12,400	
	1330	1500 watt		.20	40		9,268	970		10,238	11,600	
	1350	Sodium high pressure, 70 watt		.30	26.670		4,712	645		5,357	6,125	
	1360	100 watt		.30	26.670		4,871	645		5,516	6,300	
	1370	150 watt		.30	26.670		5,059	645		5,704	6,525	
	1380	250 watt		.30	26.670		5,380	645		6,025	6,875	
	1400	400 watt		.30	26.670		5,727	645		6,372	7,250	
	1450	1000 watt		.20	40		13,352	970		14,322	16,100	
	1500	Low pressure, 35 watt		.30	26.670		3,963	645		4,608	5,300	
	1550	55 watt		.30	26.670		4,386	645		5,031	5,775	

LUMATECH

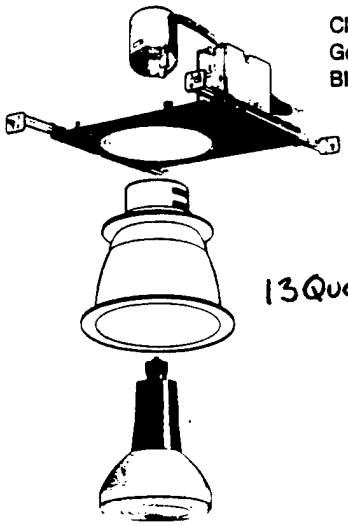
CONTRACTOR PRICE LIST

GP-N>3 p. 9 of 10

CODE		DESCRIPTION	QTY.	STD. PKG. (LBS.)	PKG. WGHT.	LIST PRICE	DISCOUNT
REFLECT-A-STAR™—COMPACT FLUORESCENT FLOODLIGHT SERIES							
10513T		PL5 3.75" Diameter Reflector	10	11	64.32		
10514T		PL5 4.50" Diameter Reflector	10	11	64.32		
10515T		PL5 5.25" Diameter Reflector	10	11	64.32		
10923		PL9Q 3.75" Diameter Reflector	10	11	73.14		
10924		PL9Q 4.50" Diameter Reflector	10	11	73.14		
10925		PL9Q 5.25" Diameter Reflector	10	11	73.14		
11324		PL13Q 4.50" Diameter Reflector	10	11	74.64		
11325		PL13Q 5.25" Diameter Reflector	10	11	74.64	37.32	
-G		Gold reflector option available in all units	ADD:		5.25	2.63	
10003-P*		Pink Lens	10	1	4.35	2.18	
10003-W		Warmtone Lens	10	1	4.35	2.18	
10003-WF		Warmtone Frost Lens	10	1	4.35	2.18	
10003-PF		Pink Frost Lens	10	1	4.35	2.18	
10003-CF		Clear Frost Lens	10	1	3.00	1.50	
10003-C		Clear Lens (Standard)	10	1	3.00	1.50	
10003-U		Ultraviolet Filter Insert Disk	10	1	4.35	2.18	
XT-125		Socket extender—extends unit 1.25"	25	4	4.95	2.48	

*IMPORTANT: To order optional lenses or filters, please specify reflector size. The last digit of the product code number for the Reflect-A-Star Series indicates the reflector diameter. "3" indicates 3¾". "4" indicates 4½" and "5" indicates 5¼".

RECESSED DOWNLIGHT KIT*

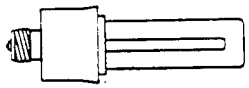
5111325		Clear Reflector Trim	12	70	176.64	88.32
5121325		Gold Reflector Trim	12	70	176.64	88.32
5131325		Black Reflector Trim	12	70	176.64	103.32

13Quad: 900 lumens as per Bruce Pelton

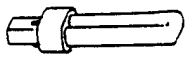
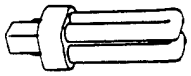
*The recessed downlight kit consists of a frame-in kit, reflector trim in clear, gold or black Alzak® aluminum and a Reflect-A-Star model number 11325 with standard reflector and lens.

*Fixture price includes lamp. "PL" or "PLQ" refers to lamp type only. GE, Osram, Philips or Sylvania lamps will be supplied at the discretion

MicroLamp™—FLUORESCENT ADAPTOR SERIES

20510		PL5	50	28	28.17	14.09
20710		PL7	50	28	28.17	14.09
20910		PL9	50	28	28.17	14.09
20920		PLQ9	50	28	39.03	19.52
21320		PLQ13	50	30	39.03	19.52

FLUORESCENT REPLACEMENT LAMPS

40510		5W Fluorescent "PL" lamp	50	4	9.00	4.50
40710		7W Fluorescent "PL" lamp	50	4	9.00	4.50
40910		9W Fluorescent "PL" lamp	50	5	9.00	4.50
41310		13W Fluorescent "PL" lamp	50	6	9.75	4.88
40920		9W Fluorescent "PLQ" lamp	50	7	15.75	7.88
41320		13W Fluorescent "PLQ" lamp	50	8	15.75	7.88

CONDITIONS OF SALE

ORDER ACCEPTANCE
Orders are subject to approval at Lumatech corporate headquarters.

PRICES
Prices are subject to change without notice. Lumatech reserves the right to accept and bill all orders at prices in effect at the time of the shipment.

TERMS
Net 30 days on approved credit only. 1½% per month will be assessed on past due invoices. Any account submitted for collection is subject to reasonable attorney fees and costs.

FREIGHT
Transportation costs will be pre-paid and billed F.O.B. Oakland, California.

RETURNS
No merchandise may be returned without prior written authorization. Authorization may be requested within 30 days from the date of original shipment. All returns will be subject to a minimum handling and factory inspection charge of 25% of invoiced amounts, plus freight, except on products considered by Lumatech to be defective in workmanship and materials.

CLAIMS FOR DAMAGE OR LOSS IN SHIPMENT
It is the responsibility of the consignee to file a claim with the transportation company in the event of lost or damaged merchandise. Immediately upon receipt of the shipment, the consignee should check for loss or damage. In the event such has occurred the consignee should file a claim with the transportation company promptly.

CANCELLATIONS
Orders are not cancelable except on payment for all costs incurred, engineering work performed, any materials purchased or commitments made on the part of Lumatech. Lumatech reserves the right to assess a minimum cancellation charge equal to 25% of the original purchase price of the order placed by the customer.

PRODUCT SPECIFICATIONS
Subject to change without notice.

CATALOG ERRORS
Every effort is made on the part of Lumatech Corporation to provide accurate pricing, dimensional and physical description information, etc. in our literature and price lists. However, as this information is subject to change without notice, we cannot accept the responsibility for any loss or damages due to informational errors in our publications. We invite your inquiry regarding up to date information.

MINIMUM ORDER
Minimum net invoice amount is $50.00. Any order under $50.00 is subject to a $10.00 handling charge.

LIMITED WARRANTY
The REFLECT-A-STAR™ and MicroLamp™ series fixtures are warranted to be free from defects in workmanship and materials, as manufactured, for a period of three years from the date of original invoice. Lamps are warranted for 90 days only.

Our invoice covers only replacement or repair at our factory of the defective part(s), to the original purchaser, and excludes any responsibility for labor or freight expense incurred by the purchaser or others, for servicing such claim during the warranty period. Lumatech reserves the right to issue credit, repair or replace defective merchandise, at our option, upon receipt of written notification by the original purchaser of the alleged defect, within the warranty period. Lumatech further reserves the right to examination of the alleged defective product, or proof satisfactory to Lumatech of the defect. This limited warranty is in lieu of all other responsibility for labor costs in connection with the installation, removal or replacement of warranted products, or for any consequential damages. Lumatech further reserves the right to refuse to honor the above warranty for any product(s) altered, improperly installed, or installed in application for which not intended.

For Authorized Dealer Contact:

LUMATECH CORPORATION
5515 Doyle St., Emeryville, CA 94608 (415) 654-4300

DOCUMENTATION FOR PRODUCTIVITY CAPITAL INVESTMENT PROGRAMS
For use of this form, see AR 5-4; the proponent agency is OCA.

1. PROJECT NO.

REQUIREMENT CONTROL SYMBOL DD-M(R) 1561

2. TO:
CDR, AMC (AMCRM-MP)
5001 Eisenhower Avenue
Alexandria, VA 22333-0001

3. THRU:

4. FROM:
CDR, AMCCOM
Attn: AMSMC-MGP-P (R)
Rock Island, IL 61299-6000

5. DOD COMP NAME: Army

6. DOD COMP CODE: A

7. COMMAND CODE: W73QKK

8. DATE:

9. PROJECT TITLE
Install Turning Vanes in Boiler Ductwork (ECO GP-X-4)

10. TYPE OF PROJECT (Check one)
[X] QRIP [ ] OSD PIF [ ] PECIP

11. AMORTIZATION YEARS/MONTHS
$ 36,630 (Project Cost) ÷ 21,998 (Average Annual Savings) X 12 (No. Mos)
= 1.7 (years) or -- (months) (amortization)

12. FUNCTIONAL AREA WHERE SAVINGS WILL OCCUR
024

13. ECONOMIC LIFE
25 yrs.

14. EXPECTED OPERATIONAL DATE

15. SUBMITTING UNIT(S)
Administrative Contracting Office
Radford Army Ammunition Pt.
Radford, VA 24141

16. UNIT ID CODE
WOLLAA

17. PROJECT DESCRIPTION
Replace the existing square corner ductwork in Power House 1 exit gas stream with rounded elbows.

18. DETAILED JUSTIFICATION
Existing square corner ductwork increased energy use for both forced draft and induced draft fans. Replacing the inside corner with rounded elbows will reduce the pressure drop and save energy.

19. SAVINGS DISPOSITION
Savings are used to reduce energy costs.

20. OTHER REMARKS (Continue on page 5, if more space is needed)

1 August 1982

21a. SUMMARY OF DOLLAR SAVINGS
(ROUND OFF TO THE NEAREST DOLLAR)

Attach computation sheet identifying the method and source of data for savings

SAVINGS BREAKOUT	PRESENT METHOD	PROPOSED METHOD				DIFFERENCE/SAVINGS			
		1ST YR	2D YR	3D YR	4TH YR	1ST YR	2D YR	3D YR	4TH YR
SALARY/LABOR/ OVERTIME									
MATERIAL/ SUPPLIES									
UTILITIES									
MAINTENANCE/ REPAIR									
TRANSPORTATION									
LEASE COSTS									
SALVAGE/ TURN-IN									
ENERGY (Identify) Electricity	33,780	9,792	9,792	9,792	9,792	21,988	21,988	21,988	21,988
CONTRACT COSTS									
OTHER (Identify) _____									
TOTALS	33,780	9,792	9,792	9,792	9,792	21,988	21,988	21,988	21,988

b. PRIORITIZATION

(1) INTERNAL RATE OF RETURN (IRR)

Divide estimated project cost 36,630 by average annual savings 21,988 = 1.67 factor.

Based on factor and number of years economic life of the project, select the IRR from Table H-3, App H, Ch. 5, AR 5-4 = 35 % IRR.

(2) SAVINGS TO INVESTMENT RATIO (S/I)

Multiply annual savings 21,988 X discount factor 11.37 = 250,004 and divide by present value of investment (undiscounted) 36,630 = 6.8 S/I.

(Based on economic life 25 years, select discount factor from Table H-4, App H, Ch. 5, AR 5-4.

(3) RATE OF INVESTMENT PER MANPOWER SPACE (RIMS) NA

Divide estimated project cost _____ by number of manpower space savings _____ = _____ RIMS.

(Manpower requirements cannot be used in this computation.)

22. COST FOR PROJECT TO BECOME OPERATIONAL

EQUIPMENT TYPE a	PROPOSED SOURCE OF PROCUREMENT b	UNIT PRICE c	QUANTITY d	TOTAL COST e	APPROPRIATION, BUDGET ACTIVITY OR PROGRAM ELEMENT f	FY FUNDS REQUIRED g
(1) Rounded Elbow Ductwork		3,663	10	36,630		
(2)						
(3)						
(4)						
(5)						
(6) TRANSPORTATION (Equipment delivery)						
(7) EQUIPMENT MODIFICATION[1]						
(8) EQUIPMENT INSTALLATION						
(9) MAINTENANCE CONTRACT[2]						
(10) FACILITIES MODIFICATION[3]						
(11) TRAINING						
(12) OTHER (Specify):						
(13) TOTAL REQUIRED FOR PROJECT TO BECOME OPERATIONAL[4]				36,630		
(14) TOTAL AMOUNT OF FUNDING REQUESTED IN THIS PROPOSAL				36,630		
(15) TOTAL AMOUNT OF FUNDING REQUIRED FROM OTHER SOURCE[5]				0		
(16) TOTAL (Sum of (14) + (15) above)				36,630		

[1] *Not to exceed 10% of equipment cost for QRIP projects.*

[2] *Applicable to OPA QRIP provided cost is included in packaged deal involving one bill for the equipment and initial maintenance.*

[3] *Normally not OPA funded.*

[4] *Used to compute amortization in Item 11.*

[5] *Specify source to include certification that funds are available, if financed from the regular budget:*

23. SUMMARY OF SAVINGS *(MANPOWER AND DOLLARS)*

ITEMS	SAVINGS			REAPPLICATION OF SAVINGS					
	NO. MPR OR MHR	TYPE PERS[6]	DOLLARS	PROGRAM ELEMENT		TDA PARA AND LINE		FUNCTION CODE	
a	b	c	d	e. FROM	f. TO	g. FROM	h. TO	i. FROM	j. TO
(1) REQUIREMENTS AND AUTHORIZATIONS ELIMINATED									
(2) REQUIREMENTS ONLY ELIMINATED									
(3) BORROWED MILITARY MANPOWER RELEASED									
(4) OVERHIRES OR TEMPORARIES TERMINATED									
(5) HOURS OVERTIME ELIMINATED									
(6) MANHOURS SAVED FROM MULTIPLE POSITIONS[7]									
(7) OTHER DOLLAR SAVINGS *(Excluding Manpower)*, e.g., CONTRACT COSTS & UTILITIES			21,988						
(8)									
(9)									
(10)									
(11) TOTAL DOLLAR SAVINGS			21,988						

6 *(1) US Graded*
(2) US Wage Board
(3) DHFN
(4) IHFN
(5) Officer
(6) WO
(7) Enlisted

[7] *Reflect specific duties being performed with additional manhours available (equivalent manyears)*

24. REGULATORY APPROVAL/COORDINATION

a. INVESTMENT STATEMENT

This proposal has been reviewed and it cannot be implemented with existing equipment or facilities. This investment is in accordance with established investment planning. The project complies with public laws, OSD policies and regulations, and all other regulatory constraints.

(Cite regulatory approvals, e.g., TAGO Control No.) (Ex. New Start, TAGO Approval, etc.)

b. OTHER COORDINATION *(Functional Coordination at local level, e.g., Fac Eng, Log, Pers, etc.)*

25. SUBMITTED BY *(Typed name, grade and title of Subordinate Command/Agency or Project Initiator)*	SIGNATURE	DATE *(YYMMDD)* AUTOVON
26. APPROVAL RECOMMENDED BY *(MACOM/Agency)*	SIGNATURE	DATE *(YYMMDD)* AUTOVON
FOR USE BY HQDA ON OSD PIF PROJECTS ONLY		
27. APPROVED BY	SIGNATURE	DATE *(YYMMDD)* AUTOVON

28. OTHER REMARKS *(Cont'd)*

(DA Form 5108-R)—Continued.

ECO# GP-X-4 INSTALL TURNING VANES IN BOILER DUCTS

PRESSURE DROP WITH EXISTING SQUARE CORNER

ASSUME: 5280 FT/min, 300°= EXIT GAS TEMP.,

ASPECT RATIO (W/D) = 1

FROM FIG 20 (ATTACHED) PRESSURE DROP is 0.8 IN.W.G

PRESSURE DROP WITH 24" RADIUS BEND IN LIEU of SQUARE CORNER ASSUME 6'x6' DUCT.

$R/D = \frac{24/12}{6} = .333$

FROM FIG 20 ΔP = 0.28 IN. W.C.

FAN ENERGY SAVED

VOLUME = 6'x6' x 5280 FT/min = 190,000 ACFM

$$\text{ENERGY} = \frac{(190{,}000)(0.8 - 0.28)}{6356 \times .7} \times 746 = 16.56 \text{ kw}$$

ASSUME 50% LOAD FACTOR ON FAN

16.56 kw x 8760 hr/yr x .5 = 72532 kwh/yr.

$72532 \text{ Kwh/yr} \times 3413 \frac{\text{BTU}}{\text{Kwh}} \times 10^{-6} \frac{\text{MBTU}}{\text{BTU}} = 248 \text{ MBTU/yr}$

Typically 3 boilers operate in winter and 2 in the summer

Assuming 2.5 boilers and 4 elbows per boiler

gives 2.5 * 4 * 248 MBTU/yr = 2480 MBTU/yr

RS&H®

SUBJECT _____ AEP NO _____

SHEET _____ OF _____

DESIGNER PFH DATE _____

CHECKER _____ DATE _____

QRIP Calc is

Current energy use =

$$\frac{(190{,}000)\ (0.8)}{6356 \times 0.7} \times \frac{7116}{1000} \times \frac{3760}{2} \times 0.03026 = \$3378/\text{elbow}$$

$\$3378 \times 10 \text{ elbows} = \$33{,}730/\text{yr.}$

FRICTION LOSS IN RECTANGULAR DUCTS

All of the losses are figured for unlined steel ducts at 70 F and A/B ratio = 1. Correct for other temperatures and ratios as shown.

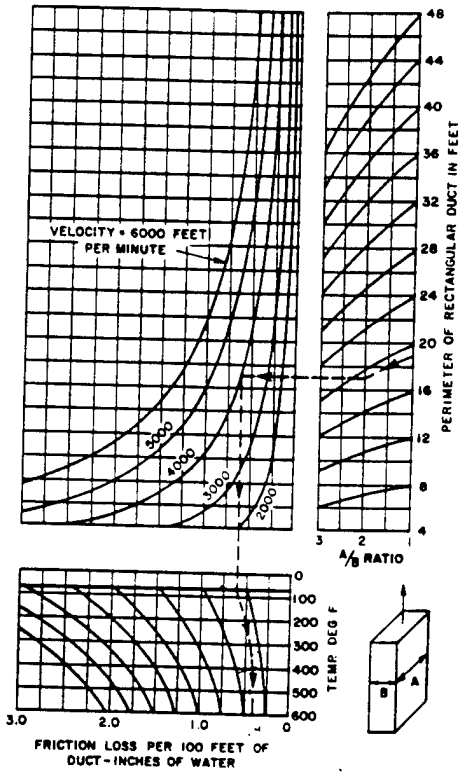


Fig. 19

FRICTION LOSS IN PLAIN RECTANGULAR ELBOWS

All of the losses are figured for unlined steel elbows at 70 F and W/D ratio = 1. Correct for other temperatures and ratios as shown.

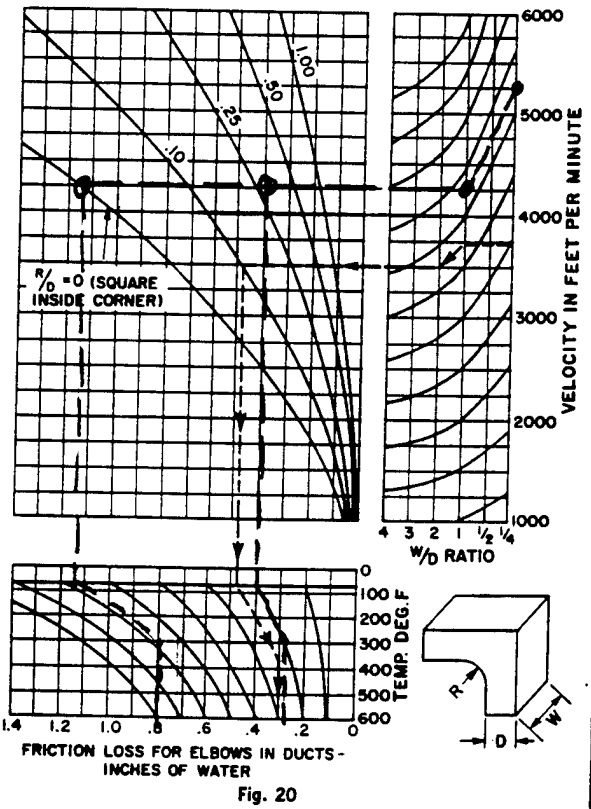


Fig. 20

24" RADIUS BEND MAT'L COST

ASSUME: 7 gage PLATE, 6 ft WIDE DUCT, $2/LB STEEL

AREA

$24 \text{ IN} \times \frac{1 \text{ ft}}{12 \text{ IN}} \times \frac{2\pi}{4} \times 6 \text{ ft} = 18.85 \text{ ft}^2/\text{bend}$

Weight

7 gage PLATE weighs $7.5 \text{ LBS}/\text{ft}^2$

$18.85 \text{ ft}^2/\text{bend} \times 7.5 \text{ LBS}/\text{ft}^2 = 141 \text{ LBS/bend}$

Cost

STEEL PLATE COSTS ABOUT $2/LB* FABRICATED

* MEANS SPECIALTY STEEL

$141 \text{ LBS/bend} \times \$2/\text{LB} = \$282/\text{bend}.$

CONSTRUCTION COST ESTIMATE	DATE PREPARED	SHEET OF

PROJECT: ENERGY ENGINEERING ANALYSIS

LOCATION: RADFORD ARMY AMMUNITION PLANT

ARCHITECT ENGINEER: REYNOLDS, SMITH AND HILLS A.E.P., INC.

BASIS FOR ESTIMATE
- ☐ CODE A (No design completed)
- ☐ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify)

DRAWING NO.

ESTIMATOR: G. Fallon

CHECKED BY: P. Hutchins

ROUNDED DUCT SUMMARY CORNER.	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
BEND COST MAT'L	1	ea			282	282	282
LABOR Q9	3	days	346.32	1039			1039
REMOVE EXISTING							
CORNER CREW Q9	.5	days	346.32	173		282	455
TOTAL				1212		282	1494
LOCATION			.683	828	1.002	282	1110
SALES TAX			1.00	828	1.045	295	1123
FICA			1.20	994	1.00	295	1289
OVERHEAD 15%							1482
PROFIT 10%							1631
BOND 1%							1647
CONTINGENCY 10%							1812
HERCULES 6%							1920
TOTAL PER ELBOW							1920
Five boilers & 4 elbows each							X20
TOTAL CONSTRUCTION COST							$38,400

DOCUMENTATION FOR PRODUCTIVITY CAPITAL INVESTMENT PROGRAMS
For use of this form, see AR 5-4; the proponent agency is OCA.

1. PROJECT NO.

REQUIREMENT CONTROL SYMBOL
DD-M(R) 1561

2. TO:
CDR, AMC (AMCRM-MP)
5001 Eisenhower Avenue
Alexandria, VA 22333-0001

3. THRU:

4. FROM:
CDR, AMCCOM
Attn: AMSMC-MGP-P (R)
Rock Island, IL 61299-6000

5. DOD COMP NAME: Army

6. DOD COMP CODE: A

7. COMMAND CODE: W73QKK

8. DATE:

9. PROJECT TITLE
Modify Boiling Tub Heating Method
(ECO NC-X-1)

10. TYPE OF PROJECT (Check one)
[X] QRIP [ ] OSD PIF [ ] PECIP

11. AMORTIZATION YEARS/MONTHS
$ 8,924 (Project Cost) ÷ 8,630 (Average Annual Savings) X 12 (No. Mos)
= 1.03 (years) or 0 (months) (amortization)

12. FUNCTIONAL AREA WHERE SAVINGS WILL OCCUR
024

13. ECONOMIC LIFE
25 years

14. EXPECTED OPERATIONAL DATE

15. SUBMITTING UNIT(S)
Administrative Contracting Office
Radford Army Ammunition Pt.
Radford, VA 24141

16. UNIT ID CODE
WOLLAA

17. PROJECT DESCRIPTION
A closed heat exchanger will be installed on one boiling tub to replace the steam percolation method currently in use.

18. DETAILED JUSTIFICATION
The steam percolation method now used allows steam to escape from the boiling tub by a "puffing" action. Using a closed heat exchanger to heat the tub contents will greatly reduce this heat loss.

19. SAVINGS DISPOSITION
Savings are used to reduce energy costs.

20. OTHER REMARKS (Continue on page 5, if more space is needed)

21a. SUMMARY OF DOLLAR SAVINGS
(ROUND OFF TO THE NEAREST DOLLAR)

Attach computation sheet identifying the method and source of data for savings

SAVINGS BREAKOUT	PRESENT METHOD	PROPOSED METHOD				DIFFERENCE/SAVINGS			
		1ST YR	2D YR	3D YR	4TH YR	1ST YR	2D YR	3D YR	4TH YR
SALARY/LABOR/ OVERTIME									
MATERIAL/ SUPPLIES									
UTILITIES									
MAINTENANCE/ REPAIR									
TRANSPORTATION									
LEASE COSTS									
SALVAGE/ TURN-IN									
ENERGY *(Identify)* Coal	23,100	14,470	14,470	14,470	14,470	8,630	8,630	8,630	8,630
CONTRACT COSTS									
OTHER *(Identify)*									
TOTALS	23,100	14,470	14,470	14,470	14,470	8,630	8,630	8,630	8,630

b. PRIORITIZATION

(1) INTERNAL RATE OF RETURN *(IRR)*

Divide estimated project cost 8,954 by average annual savings 8,630 = 1.04 factor.

Based on factor and number of years economic life of the project, select the IRR from Table H-3, App H, Ch. 5, AR 5-4 = 185 % IRR.

(2) SAVINGS TO INVESTMENT RATIO *(S/I)*

Multiply annual savings 8,630 X discount factor 13.34 = 115,124 and divide by present value of investment *(undiscounted)* 8,924 = 12.9 S/I.

(Based on economic life 25 years, select discount factor from Table H-4, App H, Ch. 5, AR 5-4.

(3) RATE OF INVESTMENT PER MANPOWER SPACE *(RIMS)* NA

Divide estimated project cost _____ by number of manpower space savings _____ = _____ RIMS.

(Manpower requivalents cannot be used in this computation.)

22. COST FOR PROJECT TO BECOME OPERATIONAL						
EQUIPMENT TYPE a	PROPOSED SOURCE OF PROCUREMENT b	UNIT PRICE c	QUANTITY d	TOTAL COST e	APPROPRIATION, BUDGET ACTIVITY OR PROGRAM ELEMENT f	FY FUNDS REQUIRED g
(1) Closed Heat Exchanger		8,924	1	8,924		
(2)						
(3)						
(4)						
(5)						
(6) TRANSPORTATION (Equipment delivery)						
(7) EQUIPMENT MODIFICATION[1]						
(8) EQUIPMENT INSTALLATION						
(9) MAINTENANCE CONTRACT[2]						
(10) FACILITIES MODIFICATION[3]						
(11) TRAINING						
(12) OTHER (Specify):						
(13) TOTAL REQUIRED FOR PROJECT TO BECOME OPERATIONAL[4]				8,924		
(14) TOTAL AMOUNT OF FUNDING REQUESTED IN THIS PROPOSAL				8,924		
(15) TOTAL AMOUNT OF FUNDING REQUIRED FROM OTHER SOURCE[5]				0		
(16) TOTAL (Sum of (14) + (15) above)				8,924		

[1] *Not to exceed 10% of equipment cost for QRIP projects.*

[2] *Applicable to OPA QRIP provided cost is included in packaged deal involving one bill for the equipment and initial maintenance.*

[3] *Normally not OPA funded.*

[4] *Used to compute amortization in Item 11.*

[5] *Specify source to include certification that funds are available, if financed from the regular budget:*

23. SUMMARY OF SAVINGS *(MANPOWER AND DOLLARS)*

ITEMS	SAVINGS			REAPPLICATION OF SAVINGS					
	NO. MPR OR MHR	TYPE PERS[6]	DOLLARS	PROGRAM ELEMENT		TDA PARA AND LINE		FUNCTION CODE	
a	b	c	d	e. FROM	f. TO	g. FROM	h. TO	i. FROM	j. TO
(1) REQUIREMENTS AND AUTHORIZATIONS ELIMINATED									
(2) REQUIREMENTS ONLY ELIMINATED									
(3) BORROWED MILITARY MANPOWER RELEASED									
(4) OVERHIRES OR TEMPORARIES TERMINATED									
(5) HOURS OVERTIME ELIMINATED									
(6) MANHOURS SAVED FROM MULTIPLE POSITIONS[7]									
(7) OTHER DOLLAR SAVINGS *(Excluding Manpower)*, e.g., CONTRACT COSTS & UTILITIES			8,630						
(8)									
(9)									
(10)									
(11) TOTAL DOLLAR SAVINGS			8,630						

[6] *(1) US Graded*
(2) US Wage Board
(3) DHFN
(4) IHFN
(5) Officer
(6) WO
(7) Enlisted

[7] *Reflect specific duties being performed with additional manhours available (equivalent manyears)*

24. REGULATORY APPROVAL/COORDINATION

a. INVESTMENT STATEMENT

This proposal has been reviewed and it cannot be implemented with existing equipment or facilities. This investment is in accordance with established investment planning. The project complies with public laws, OSD policies and regulations, and all other regulatory constraints.

_____

(Cite regulatory approvals, e.g., TAGO Control No.) (Ex. New Start, TAGO Approval, etc.)

b. OTHER COORDINATION *(Functional Coordination at local level, e.g., Fac Eng, Log, Pers. etc.)*

_____

_____

25. SUBMITTED BY *(Typed name, grade and title of Subordinate Command/Agency or Project Initiator)*	SIGNATURE	DATE *(YYMMDD)* AUTOVON
26. APPROVAL RECOMMENDED BY *(MACOM/Agency)*	SIGNATURE	DATE *(YYMMDD)* AUTOVON

FOR USE BY HQDA ON OSD PIF PROJECTS ONLY

27. APPROVED BY	SIGNATURE	DATE *(YYMMDD)* AUTOVON

28. OTHER REMARKS *(Cont'd)*

Figure H–1. Documentation for Productivity Capital Investment Program (DA Form 5108–R)—Continued.

RS&H®

SUBJECT _____ AEP NO _____

SHEET 1 OF _____

DESIGNER GA DATE 9-24-90

CHECKER RA DATE _____

ECO # NC -X- 1 INSTALL BOILING TUB HEAT EXCHANGER

Hercules data shows boiling tubs consume 1408 LBS/HR of 40 psig STEAM for a tub on boil.

HEAT CONSUMPTION

$$\frac{1408 \text{ LBS/HR/TUB} \times 1175 \text{ BTU/LB}}{10^6 \text{ BTU/MBTU}} = 1.654 \text{ MBTU/HR/TUB}$$

OTHER DATA SHOWS A TUB IS ON BOIL for ABOUT 75% of its cycle

ANNUAL HEAT CONSUMED

1.654 MBTU/HR/TUB X 8760 X .75 = 10,870 MBTU/yearTUB

PERCENT HEAT SAVED BY CONDENSING STEAM

$$\% - \frac{h_{fg}}{h_f} \times 100$$

$$= \frac{919 \text{ BTU/LB}}{1175 \text{ BTU/LB}} \times 100 = 78.2\%$$

ANNUAL HEAT SAVED @ TUBS

10,870 MBTU/year/TUB X .782 = 8501 MBTU/yr/TUB

ANNUAL COAL SAVING

Coal savings = 8501 x 1.32 = 11,221 MBtu/tub

3/91

RS&H®

SUBJECT _____ AEP NO _____

SHEET 2 OF _____

DESIGNER GF DATE _____

CHECKER [illegible] DATE _____

NC-X-1

Electricity price differential costs:

$1.11/MBTU HOFSTM. × 8501 MBTU = $9436 /yr /HUB

RS&H®

SUBJECT _____ AEP NO _____

SHEET 3 OF _____

DESIGNER BJ DATE 9/25/90

CHECKER BJA DATE _____

NC-X-1

CALCULATE # of tubs used each year

27.9×10^6 # NC/yr ÷ 30,000 LBS NC/TUB cycle = 930 Tub cycles/yr

$$\frac{930 \text{ Tub cy/yr} \times 100 \text{ HR/cy}}{8760 \text{ HR/yr}} = 10.6 \text{ TUBS} \approx 11 \text{ TUBS.}$$

assuming 85% AVAILABILITY

$$\frac{11 \text{ TUBS}}{.85} = 12.9 \approx 13 \text{ TUBS.}$$

RAAP COAL ENERGY SAVINGS

11,221 MBTU/yr/TUB × 11 TUBS = 123,431 MBTU COAL/yr

123,431 * $1.61 = $198,724/yr.

Electricity Price Differential Costs:

$$\frac{8501 \text{ MBtu}}{\text{tub}} * \$1.11/\text{MBtu} * 11 \text{ tubs} = \$103,797$$

RAAP NET SAVINGS

$198,724 - 103,797 = $ 94,927/yr

3/91

RS&H®

SUBJECT _____ AEP NO _____

SHEET 4 OF _____

DESIGNER GF DATE _____

CHECKER QH DATE _____

NC-X-1

TOTAL INSTALLED COST

COST = $44613 FOR 5 TUBS

$\frac{\$44613}{5 \text{ TUBS}} \times 13 \text{ TUBS} = \$115,993$

SIMPLE PAYBACK

$\frac{\$115,993}{94,927} = 1.2 \text{ yrs}$

For QRIP:

TOTAL COAL USED PER TUB

$10,870 \text{ mBtu/yr/tub} * 1.32 \frac{\text{mBtu coal}}{\text{mBtu stm}} = 14,348 \text{ mBtu}$

FUEL COST = $14,348 \text{ mBtu} * \$1.61/\text{mBtu} = \$23,100$

SAVINGS = COAL SAVINGS − ELEC PRICE DIFF COSTS

= $(11,221 \text{ mBtu} * \$1.61) - \$9436 = \$8630$

DIFF (PROPOSED METHOD) = $14,470

COST = $\$115,993 / 5 =$ = $8924

3/91

CONSTRUCTION COST ESTIMATE	DATE PREPARED	SHEET OF

PROJECT: ENERGY ENGINEERING ANALYSIS

LOCATION: RADFORD ARMY AMMUNITION PLANT

ARCHITECT ENGINEER: REYNOLDS, SMITH AND HILLS A.E.P., INC.

BASIS FOR ESTIMATE: ☐ CODE A (No design completed) ☐ CODE B (Preliminary design) ☐ CODE C (Final design) ☐ OTHER (Specify)

DRAWING NO.: ECO # ~~GP~~ NC-X-1 | ESTIMATOR: Gaillon | CHECKED BY:

PERC. LINE H/X SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
HEAT EXCHANGER							
3" SS 150 LB FLANGE	4	ea	29.00	116	129.15	517	633
SS 150 LB 4X3 REDUCE	2	ea	30.00	60	100.00	200	260
3" SCH 80 316 PIPE	20	FT	8.60	172	57.28	1145	1317
4" SCH 40 316 PIPE	20	FT	9.05	181	35.36	707	888
PUMP							
MECH	1	ea	88	88	1560	1560	1648
ELEC (means pg 277)	1	ea	430	430	290	290	720
INSULATION							
4" PIPE - 2" THK	20	FT	2.99	60	5.57	111	171
SUB TOTAL (ONE TUB)				1107		4530	5637
5 TUBS	5		1107	5535	4530	22650	28185
LOCATION FACTOR			.683	3780	1.002	22695	26475
SALES TAX			1	3780	1.045	23716	27496
FICA INS			1.2	4536	1.00	23716	28252
OVER HEAD 15%							32490
PROFIT 10%							35739
BOND 1%							36096
CONTINGENCY 10%							39706
HERCULES 6%							42088
DESIGN FEE 6%							44613
TOTAL							44613
13 TUBS	13/5						$115,994
SOURCE: 1985 MEANS							

OSD PIF

DOCUMENTATION FOR PRODUCTIVITY CAPITAL INVESTMENT PROGRAMS
For use of this form, see AR 5-4; the proponent agency is OCA.

1. PROJECT NO.

REQUIREMENT CONTROL SYMBOL DD-M(R) 1561

2. TO: HQ. DA (EACA-RMP)
Rm 3B719 (Pentagon)
Washington, DC 20310-2070

3. THRU: CDR, AMC (AMCRM-MP)
5001 Eisenhower Avenue
Alexandria, VA 22333-0001

4. FROM: CDR, AMCCOM
Attn: AMSMC-MGP-P (R)
Rock Island, IL 61299-6000

5. DOD COMP NAME: Army

6. DOD COMP CODE: A

7. COMMAND CODE: W73QKK

8. DATE:

9. PROJECT TITLE: Install Variable Frequency Drives on Plant Water Pumps (ECO GP-B-4)

10. TYPE OF PROJECT (Check one)
☐ ORIP ☒ OSD PIF ☐ PECIP

11. AMORTIZATION YEARS/MONTHS
$ 185,735 (Project Cost) ÷ 96,994 (Average Annual Savings) X 12 (No. Mos)
= 1.9 (years) or -- (months) (amortization)

12. FUNCTIONAL AREA WHERE SAVINGS WILL OCCUR: 024

13. ECONOMIC LIFE: 15 yrs.

14. EXPECTED OPERATIONAL DATE:

15. SUBMITTING UNIT(S)	16. UNIT ID CODE
Administrative Contracting Office Radford Army Ammunition Pt. Radford, VA 24141	WOLLAA

17. PROJECT DESCRIPTION
Install variable frequency drives on the water supply pumps so that the water pumped will match the water required.

18. DETAILED JUSTIFICATION
Currently, water is pumped from the New River at a constant rate of about 24,000,000 gallons per day, with a plant usage of about 14,000,000 gallons per day. The remainder is returned to the river. Variable frequency drives would allow the existing pumps to reduce flow to match the demand.

19. SAVINGS DISPOSITION

20. OTHER REMARKS (Continue on page 5, if more space is needed)

21a. SUMMARY OF DOLLAR SAVINGS
(ROUND OFF TO THE NEAREST DOLLAR)

Attach computation sheet identifying the method and source of data for savings

SAVINGS BREAKOUT	PRESENT METHOD	PROPOSED METHOD				DIFFERENCE/SAVINGS			
		1ST YR	2D YR	3D YR	4TH YR	1ST YR	2D YR	3D YR	4TH YR
SALARY/LABOR/ OVERTIME									
MATERIAL/ SUPPLIES									
UTILITIES									
MAINTENANCE/ REPAIR									
TRANSPORTATION									
LEASE COSTS									
SALVAGE/ TURN-IN									
ENERGY *(Identify)* Electricity	287,240	190,246	190,246	190,246	190,246	96,994	96,994	96,994	96,994
CONTRACT COSTS									
OTHER *(Identify)* _____									
TOTALS	287,240	190,246	190,246	190,246	190,246	96,994	96,994	96,994	96,994

b. PRIORITIZATION

(1) INTERNAL RATE OF RETURN *(IRR)*

Divide estimated project cost 185,735 by average annual savings 96,994 = 1.91 factor.

Based on factor and number of years economic life of the project, select the IRR from Table H-3, App H, Ch. 5, AR 5-4 = 72 % IRR.

(2) SAVINGS TO INVESTMENT RATIO *(S/I)*

Multiply annual savings 96,994 X discount factor 8.78 = 851,607 and divide by present value of investment *(undiscounted)* 185,735 = 4.6 S/I.

(Based on economic life 15 years, select discount factor from Table H-4, App H, Ch. 5, AR 5-4.

(3) RATE OF INVESTMENT PER MANPOWER SPACE *(RIMS)* NA

Divide estimated project cost _____ by number of manpower space savings _____ = _____ RIMS.

(Manpower requirements cannot be used in this computation.)

22. COST FOR PROJECT TO BECOME OPERATIONAL

EQUIPMENT TYPE a	PROPOSED SOURCE OF PROCUREMENT b	UNIT PRICE c	QUANTITY d	TOTAL COST e	APPROPRIATION, BUDGET ACTIVITY OR PROGRAM ELEMENT f	FY FUNDS REQUIRED g
(1) 600 hp Variable Freq. Drive		97,590	1	97,590		
(2) 400 hp Variable Freq. Drive		66,109	1	66,109		
(3) 100 hp Variable Freq. Drive		22,036	1	22,036		
(4)						
(5)						
(6) TRANSPORTATION (Equipment delivery)						
(7) EQUIPMENT MODIFICATION[1]						
(8) EQUIPMENT INSTALLATION						
(9) MAINTENANCE CONTRACT[2]						
(10) FACILITIES MODIFICATION[3]						
(11) TRAINING						
(12) OTHER (Specify):						
(13) TOTAL REQUIRED FOR PROJECT TO BECOME OPERATIONAL[4]				185,735		
(14) TOTAL AMOUNT OF FUNDING REQUESTED IN THIS PROPOSAL				185,735		
(15) TOTAL AMOUNT OF FUNDING REQUIRED FROM OTHER SOURCE[5]				0		
(16) TOTAL (Sum of (14) + (15) above)				185,735		

[1] *Not to exceed 10% of equipment cost for QRIP projects.*

[2] *Applicable to OPA QRIP provided cost is included in packaged deal involving one bill for the equipment and initial maintenance.*

[3] *Normally not OPA funded.*

[4] *Used to compute amortization in Item 11.*

[5] *Specify source to include certification that funds are available, if financed from the regular budget:*

23. SUMMARY OF SAVINGS *(MANPOWER AND DOLLARS)*

ITEMS	SAVINGS			REAPPLICATION OF SAVINGS					
	NO. MPR OR MHR	TYPE PERS[6]	DOLLARS	PROGRAM ELEMENT		TDA PARA AND LINE		FUNCTION CODE	
a	b	c	d	e. FROM	f. TO	g. FROM	h. TO	i. FROM	j. TO
(1) REQUIREMENTS AND AUTHORIZATIONS ELIMINATED									
(2) REQUIREMENTS ONLY ELIMINATED									
(3) BORROWED MILITARY MANPOWER RELEASED									
(4) OVERHIRES OR TEMPORARIES TERMINATED									
(5) HOURS OVERTIME ELIMINATED									
(6) MANHOURS SAVED FROM MULTIPLE POSITIONS[7]									
(7) OTHER DOLLAR SAVINGS *(Excluding Manpower)*, e.g., CONTRACT COSTS & UTILITIES			96,994						
(8)									
(9)									
(10)									
(11) TOTAL DOLLAR SAVINGS			96,994						

6 *(1) US Graded*
(2) US Wage Board
(3) DHFN
(4) IHFN
(5) Officer
(6) WO
(7) Enlisted

[7] *Reflect specific duties being performed with additional manhours available (equivalent manyears)*

24. REGULATORY APPROVAL/COORDINATION

a. INVESTMENT STATEMENT

This proposal has been reviewed and it cannot be implemented with existing equipment or facilities. This investment is in accordance with established investment planning. The project complies with public laws, OSD policies and regulations, and all other regulatory constraints.

_____

(Cite regulatory approvals, e.g., TAGO Control No.) (Ex. New Start, TAGO Approval, etc.)

b. OTHER COORDINATION *(Functional Coordination at local level, e.g., Fac Eng, Log, Pers, etc.)*

_____

_____

25. SUBMITTED BY *(Typed name, grade and title of Subordinate Command/Agency or Project Initiator)*	SIGNATURE	DATE *(YYMMDD)* AUTOVON
26. APPROVAL RECOMMENDED BY *(MACOM/Agency)*	SIGNATURE	DATE *(YYMMDD)* AUTOVON

FOR USE BY HQDA ON OSD PIF PROJECTS ONLY

27. APPROVED BY	SIGNATURE	DATE *(YYMMDD)* AUTOVON

28. OTHER REMARKS *(Cont'd)*

Figure H-1. Documentation for Productivity Capital Investment Program (DA Form 5108-R)—Continued.

REYNOLDS, SMITH AND HILLS
ARCHITECTS • ENGINEERS • PLANNERS
INCORPORATED

SUBJECT
AEP NO
DESIGNER PFH
SHEET / OF
DATE 5/31/90
CHECKER
DATE

ECO # GP-B-4

Install variable frequency drives in main plant water supply pumps

1. Calculate current energy use

Current practice is to operate 1-600 hp turbine pump plus 1-100 hp deep well and 1-400 hp booster pump in combination. The current average flow rate is 24 million gal/da.

Turbine pump:

kW_T = volts · amps · $\sqrt{3}$ / 1000

= 2300 · 127 · $\sqrt{3}$ / 1000 = 506 kW

Deep well pump:

kW_D = 2300 · 23 · $\sqrt{3}$ / 1000 = 92 kW

Boooster pump

kW_B = 2200 · 130 · $\sqrt{3}$ / 1000 = 495 kW

Total kW = 506 + 92 + 495 = 1093 kW

Average annual usage = 1093 · 3760 = 9,574,680 kWh

Average annual cost = 9,574,680 * 0.03 = $287,240

Annual usage (MBtu) = 9,574,680 * 3413 = 32,678 MBtu

2. Calculate energy savings

Calculate system head for following current conditions

$ehp = 1093$ kW
$\eta_p = 0.70$
$\eta_m = 0.95$
$Q = 24{,}000{,}000$ gal/da $= 16{,}667$ gpm

$ehp = bhp / \eta_m$ $\qquad kW = 0.75 * ehp$

$bhp = whp / \eta_p$ $\qquad ehp = kW / 0.75$

$ehp = whp / \eta_m / \eta_p$

$$whp = \frac{H \cdot Q}{3960}$$

$$ehp = \frac{H \cdot Q}{3960 \cdot \eta_p \cdot \eta_m} = \frac{kW}{0.75}$$

$$H = \frac{kW \cdot 3960 \cdot \eta_p \cdot \eta_m}{Q \cdot 0.75}$$

$$H = \frac{1093 \cdot 3960 \cdot 0.70 \cdot 0.95}{16{,}667 \cdot 0.75}$$

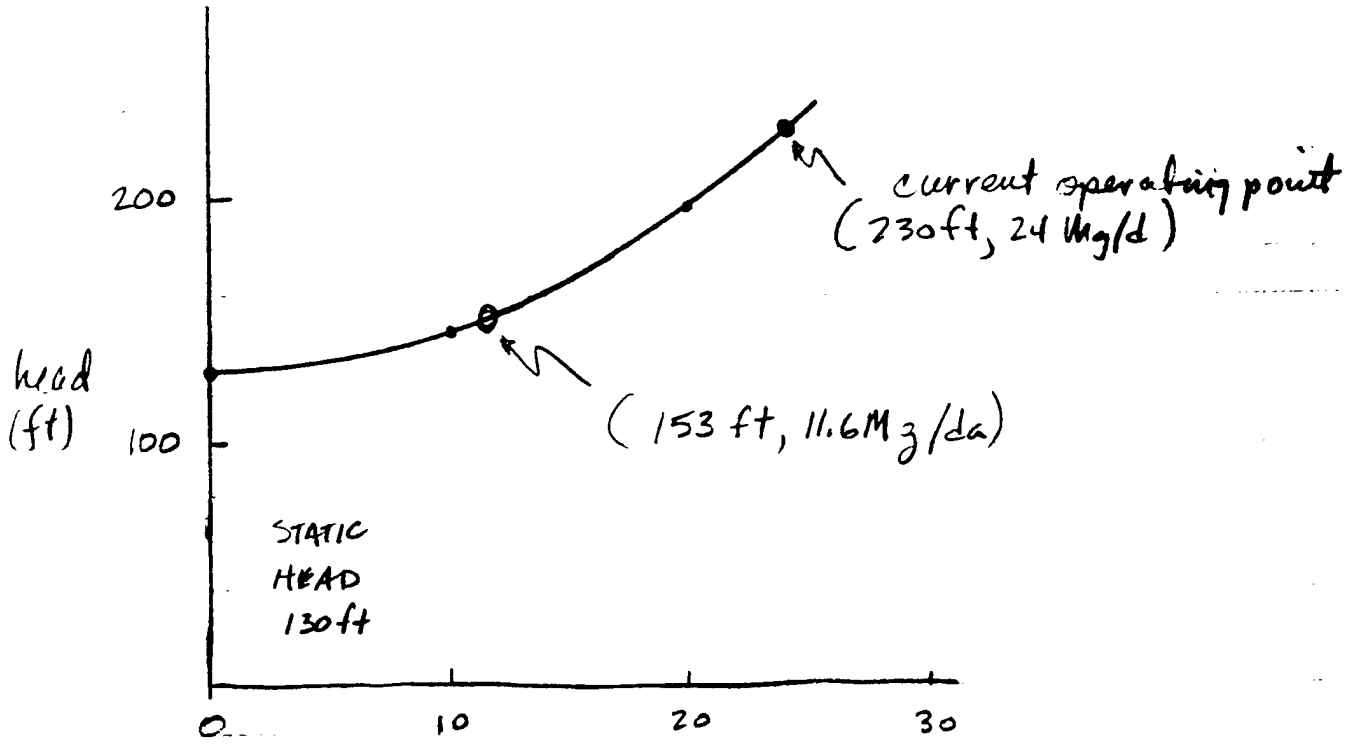
$H = 230$ feet

Assume static head is about 150 feet.

REYNOLDS. SMITH AND HILLS
ARCHITECTS • ENGINEERS • PLANNERS
INCORPORATED

SUBJECT ..... AEP NO .....
SHEET ..... OF .....
DESIGNER ..... DATE .....
CHECKER ..... DATE .....

Water Plant System Curve



$$\text{savings} = \text{current use} - \text{current} * \frac{\text{new head}}{\text{old head}}$$

$$= \text{current use}\left(1 - \frac{H_n}{H_o}\right)$$

$$= 32{,}678\ \text{MBtu}\left(1 - \frac{153}{230}\right) =$$

$$= \underline{\underline{10{,}940\ \text{MBtu}}}\ \text{(electricity)}$$

Telephone Call Confirmation

reynolds, smith and hills

Project No. 290-0379-000
(904) 281-0394

Local ✓ L.D. _____ Placed ✓ Rec'd _____ Date 5/29/90

P. Hutchins Conversed with Mark Riffle

Of Westinghouse Elec. Corp. Regarding Variable Frequency Drives

MR gave budget estimates for variable speed drives

	labor	materials
600 hp	$2000	$60,000
450 hp	$2000	$40,000
100 hp	$2000	$12,000

Distribution:

CONSTRUCTION COST ESTIMATE	DATE PREPARED	SHEET OF

PROJECT: ENERGY ENGINEERING ANALYSIS

LOCATION: RADFORD ARMY AMMUNITION PLANT

ARCHITECT ENGINEER: REYNOLDS, SMITH AND HILLS A.E.P., INC.

BASIS FOR ESTIMATE
- ☐ CODE A (No design completed)
- ☐ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify)

DRAWING NO.: ECO # GP-B-4

ESTIMATOR: P. Hutchins

CHECKED BY:

VARIABLE SPEED DRIVES SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
1-600 hp VSD	1	ea		2000		60,000	62,000
1-400 hp VSD	1	ea		2000		40,000	42,000
1-100 hp VSD	1	ea		2000		12,000	14,000
Subtotal				6000		112,000	118,000
Sales Tax (4.5%)						5040	5040
FICA/Ins. (20%)				1200			1200
Subtotal				7200		117,040	124,240
Overhead (15%)							18,636
Profit (10%)							14,288
Bond (1%)							1572
Hercules Support (6%)							9524
Contingency (10%)							16826
Construction Cost							$185,086

Vendor quote Westinghouse

DOCUMENTATION FOR PRODUCTIVITY CAPITAL INVESTMENT PROGRAMS
For use of this form, see AR 5-4; the proponent agency is OCA.

1. PROJECT NO.

REQUIREMENT CONTROL SYMBOL DD-M(R) 1561

2. TO:
HQ. DA (EACA-RMP)
Rm 3B719 (Pentagon)
Washington, DC 20310-2070

3. THRU:
CDR, AMC (AMCRM-MP)
5001 Eisenhower Avenue
Alexandria, VA 22333-0001

4. FROM:
CDR, AMCCOM
Attn: AMSMC-MGP-P (R)
Rock Island, IL 61299-6000

5. DOD COMP NAME: Army

6. DOD COMP CODE: A

7. COMMAND CODE: W73QKK

8. DATE:

9. PROJECT TITLE
Replace Incandescents with 35 W HPS Screw-Ins (ECO GP-N-1)

10. TYPE OF PROJECT (Check one)
☐ QRIP ☒ OSD PIF ☐ PECIP

11. AMORTIZATION YEARS/MONTHS
$ 126,001 (Project Cost) ÷ 65,833 (Average Annual Savings) X 12 (No. Mos)
= 1.9 (years) or -- (months) (amortization)

12. FUNCTIONAL AREA WHERE SAVINGS WILL OCCUR
024

13. ECONOMIC LIFE

14. EXPECTED OPERATIONAL DATE

15. SUBMITTING UNIT(S)
Administrative Contracting Office
Radford Army Ammunition Pt.
Radford, VA 24141

16. UNIT ID CODE
WOLLAA

17. PROJECT DESCRIPTION
Replace incandescent lamps in explosion-proof fixtures with 35 watt high pressure sodium screw-in lamps.

18. DETAILED JUSTIFICATION
High pressure sodium lamps are much more energy efficient than incandescent lamps. Replacement in areas where color rendition is not critical will save energy.

19. SAVINGS DISPOSITION
Savings are used to reduce energy costs.

20. OTHER REMARKS (Continue on page 5, if more space is needed)

1 August 1982

21a. SUMMARY OF DOLLAR SAVINGS
(ROUND OFF TO THE NEAREST DOLLAR)

Attach computation sheet identifying the method and source of data for savings

SAVINGS BREAKOUT	PRESENT METHOD	PROPOSED METHOD				DIFFERENCE/SAVINGS			
		1ST YR	2D YR	3D YR	4TH YR	1ST YR	2D YR	3D YR	4TH YR
SALARY/LABOR/ OVERTIME									
MATERIAL/ SUPPLIES	32,968	10,857	10,857	10,857	10,857	22,111	22,111	22,111	22,111
UTILITIES									
MAINTENANCE/ REPAIR	11,813	3,572	3,572	3,572	3,572	8,241	8,241	8,241	8,241
TRANSPORTATION									
LEASE COSTS									
SALVAGE/ TURN-IN									
ENERGY (Identify) Electricity	49,208	13,799	13,799	13,799	13,799	35,481	35,481	35,481	35,481
CONTRACT COSTS									
OTHER (Identify) _____									
TOTALS	94,061	28,228	28,228	28,228	28,228	65,833	65,833	65,833	65,833

b. PRIORITIZATION

(1) INTERNAL RATE OF RETURN (*IRR*)

Divide estimated project cost 126,001 by average annual savings 65,833 = 1.91 factor.

Based on factor and number of years economic life of the project, select the IRR from Table H-3, App H, Ch. 5, AR 5-4 = 72 % IRR.

(2) SAVINGS TO INVESTMENT RATIO (*S/I*)

Multiply annual savings 65,833 X discount factor 8.78 = 578,014 and divide by present value of investment *(undiscounted)* 126,001 = 4.6 S/I.

(Based on economic life 15 years, select discount factor from Table H-4, App H, Ch. 5, AR 5-4.

(3) RATE OF INVESTMENT PER MANPOWER SPACE (*RIMS*) NA

Divide estimated project cost _____ by number of manpower space savings _____ = _____ RIMS.

(Manpower requivalents cannot be used in this computation.)

22. COST FOR PROJECT TO BECOME OPERATIONAL

EQUIPMENT TYPE a	PROPOSED SOURCE OF PROCUREMENT b	UNIT PRICE c	QUANTITY d	TOTAL COST e	APPROPRIATION, BUDGET ACTIVITY OR PROGRAM ELEMENT f	FY FUNDS REQUIRED g
(1) 35 watt HPS lamps		72.41	1,740	126,001		
(2)						
(3)						
(4)						
(5)						
(6) TRANSPORTATION (Equipment delivery)						
(7) EQUIPMENT MODIFICATION[1]						
(8) EQUIPMENT INSTALLATION						
(9) MAINTENANCE CONTRACT[2]						
(10) FACILITIES MODIFICATION[3]						
(11) TRAINING						
(12) OTHER (Specify):				126,001		
(13) TOTAL REQUIRED FOR PROJECT TO BECOME OPERATIONAL[4]				126,001		
(14) TOTAL AMOUNT OF FUNDING REQUESTED IN THIS PROPOSAL				--		
(15) TOTAL AMOUNT OF FUNDING REQUIRED FROM OTHER SOURCE[5]				126,001		
(16) TOTAL (Sum of (14) + (15) above)						

[1] *Not to exceed 10% of equipment cost for QRIP projects.*

[2] *Applicable to OPA QRIP provided cost is included in packaged deal involving one bill for the equipment and initial maintenance.*

[3] *Normally not OPA funded.*

[4] *Used to compute amortization in Item 11.*

[5] *Specify source to include certification that funds are available, if financed from the regular budget:*

23. SUMMARY OF SAVINGS *(MANPOWER AND DOLLARS)*

ITEMS	SAVINGS			REAPPLICATION OF SAVINGS					
	NO. MPR OR MHR	TYPE PERS[6]	DOLLARS	PROGRAM ELEMENT		TDA PARA AND LINE		FUNCTION CODE	
a	b	c	d	e. FROM	f. TO	g. FROM	h. TO	i. FROM	j. TO
(1) REQUIREMENTS AND AUTHORIZATIONS ELIMINATED									
(2) REQUIREMENTS ONLY ELIMINATED									
(3) BORROWED MILITARY MANPOWER RELEASED									
(4) OVERHIRES OR TEMPORARIES TERMINATED									
(5) HOURS OVERTIME ELIMINATED									
(6) MANHOURS SAVED FROM MULTIPLE POSITIONS[7]			8,241						
(7) OTHER DOLLAR SAVINGS *(Excluding Manpower)*, e.g., CONTRACT COSTS & UTILITIES			57,592						
(8)									
(9)									
(10)									
(11) TOTAL DOLLAR SAVINGS			65,833						

[6] *(1) US Graded*
(2) US Wage Board
(3) DHFN
(4) IHFN
(5) Officer
(6) WO
(7) Enlisted

[7] *Reflect specific duties being performed with additional manhours available (equivalent manyears)*

24. REGULATORY APPROVAL/COORDINATION

a. INVESTMENT STATEMENT

This proposal has been reviewed and it cannot be implemented with existing equipment or facilities. This investment is in accordance with established investment planning. The project complies with public laws, OSD policies and regulations, and all other regulatory constraints.

(Cite regulatory approvals, e.g., TAGO Control No.) (Ex. New Start, TAGO Approval, etc.)

b. OTHER COORDINATION *(Functional Coordination at local level, e.g., Fac Eng, Log, Pers, etc.)*

25. SUBMITTED BY *(Typed name, grade and title of Subordinate Command/Agency or Project Initiator)*	SIGNATURE	DATE *(YYMMDD)* AUTOVON
26. APPROVAL RECOMMENDED BY *(MACOM/Agency)*	SIGNATURE	DATE *(YYMMDD)* AUTOVON

FOR USE BY HQDA ON OSD PIF PROJECTS ONLY

27. APPROVED BY	SIGNATURE	DATE *(YYMMDD)* AUTOVON

28. OTHER REMARKS *(Cont'd)*

Figure H-1. Documentation for Productivity Capital Investment Program (DA Form 5108-R)—Continued.

24. REGULATORY APPROVAL/COORDINATION

a. INVESTMENT STATEMENT

This proposal has been reviewed and it cannot be implemented with existing equipment or facilities. This investment is in accordance with established investment planning. The project complies with public laws, OSD policies and regulations, and all other regulatory constraints.

(Cite regulatory approvals, e.g., TAGO Control No.) (Ex. New Start, TAGO Approval, etc.)

b. OTHER COORDINATION *(Functional Coordination at local level, e.g., Fac Eng, Log, Pers, etc.)*

25. SUBMITTED BY *(Typed name, grade and title of Subordinate Command/Agency or Project Initiator)*	SIGNATURE	DATE *(YYMMDD)* AUTOVON
26. APPROVAL RECOMMENDED BY *(MACOM/Agency)*	SIGNATURE	DATE *(YYMMDD)* AUTOVON

FOR USE BY HQDA ON OSD PIF PROJECTS ONLY

27. APPROVED BY	SIGNATURE	DATE *(YYMMDD)* AUTOVON

28. OTHER REMARKS *(Cont'd)*

Figure H–1. Documentation for Productivity Capital Investment Program *(DA Form 5108–R)*—Continued.

REYNOLDS, SMITH AND HILLS
ARCHITECTS • ENGINEERS • PLANNERS
INCORPORATED

SUBJECT RAAP Lighting Projects AEP NO 290 0379 000
SHEET 1 OF 10
DESIGNER T. Todd DATE
CHECKER DATE

GP-N-1 REPLACE INCANDESCENTS WITH 35 W HPS SCREW-INS FOR EXPLOSION-PROOF FIXTURES

Calculations were made on a per-unit basis for installing 35 W HPS "units" within the existing explosion-proof incandescent fixtures. These units consist of a HPS lamp and a ballast with a medium base adapter which screws into the incandescent socket. The per-unit calculations are on page 2.

From the building survey data, a list was compiled of the buildings with potential incandescent lighting projects (page 3). Only areas with lighting operating 3 shifts/day, 5 days/wk were considered. It is assumed that 90% of the interior and 50% of the exterior fixtures can be retrofitted in the manner described above for this ECO.

Total fixtures = $0.9(1536) + 0.5(717) = 1740$

Energy savings = 674 kwh/yr × 0.003413 MBtu/kwh × 1740 fixtures = 4003 MBtu/yr

Energy cost savings = $\frac{\$20.39}{\text{yr-fixture}} \times 1740 \text{ fixtures} = \$35,479/\text{yr}$

Labor & matl cost savings = $\frac{\$17.44}{\text{yr-fixture}} \times 1740 = \$30,346/\text{yr}$

Total cost savings = \$35479 + \$30346 = \$65,825/yr

Project cost = $\frac{\$80.46}{\text{fixture}} \times 1740 \text{ fixtures} = \$140,000$

(Construction cost = \$140,000 / 1.115 = \$125,561)

Simple payback = $\frac{\$140,000}{\$65,825/\text{yr}} = 2.1 \text{ yr}$

REYNOLDS, SMITH AND HILLS
ARCHITECTS • ENGINEERS • PLANNERS
INCORPORATED

SUBJECT RAAP Lighting Projects Screening Calcs.
DESIGNER T. Todd
CHECKER

AEP NO 290 0379 000
SHEET 2 OF 10
DATE
DATE

GP-N-1 Replace int/ext 150-200W incandescents with 35 W HPS screw-in retrofits for explosion-proof applications *

$$\text{Energy savings} = (150\text{W} - 42\text{W}) \times \frac{24\text{ hr}}{\text{day}} \times \frac{260\text{ days}}{\text{yr}} = 674\ \frac{\text{kwh}}{\text{yr}}$$

$$\text{Energy Cost Savings} = 674\ \frac{\text{kwh}}{\text{yr}} \times \frac{\$0.03026}{\text{kwh}} = \frac{\$20.39}{\text{yr}}$$

$$\text{Labor \& Mat'l cost savings} = \left(\frac{\text{Incand. cost}}{750\text{ hr}} - \frac{\text{HPS cost}}{16000\text{ hr}}\right) \times 6240\ \frac{\text{hr}}{\text{yr}}$$

$$= \left[\frac{(\$2.11\text{ matl} + \$1.20\text{ labor} \times 0.683 \times 1.2\text{ exp-prf})}{750\text{ hr}} - \frac{(\$16\text{ matl} + \$6.45\text{ labor} \times 0.683 \times 1.2)}{16{,}000\text{ hr}}\right] \times \frac{6240\text{ hr}}{\text{yr}} = \frac{\$17.44}{\text{yr}}$$

$$\text{Total cost savings} = \frac{\$20.39}{\text{yr}} + \frac{\$17.44}{\text{yr}} = \frac{\$37.83}{\text{yr}}$$

Mat'l cost = $45 for fixture w/ lamp (1990 vendor info.)

Labor cost = $1.20 × 1.20 × 1.20 exp-prof × 0.683 = $1.18
(cost of replacing exp-proof incand, +20%)

Project Cost = [(1.045 × $45) + (1.2 × $1.18)] × 1.661 = $80.46

Simple payback = $\frac{\$80.46}{\$37.83/\text{yr}}$ = 2.1 yr < 10 yr

Note: HPS lamps are replaceable in the retrofit ballasts.

* It must be verified that the screw-in retrofits will fit in all fixtures.

RS&H®

SUBJECT _____ AEP NO _____

_____ SHEET _____ OF _____

DESIGNER _____ DATE _____

CHECKER _____ DATE _____

QRIP Calc's

Current energy use for 1740 lamps:

$$\frac{150\ W}{1000} * 24 * 260 * 0.03026 * 1740 = \$49,280/yr$$

Current mat'l & labor costs:

$$\frac{2.11 + 1.2 * 0.68 * 12}{750} * 6240 * 1740 = \$44,731/yr$$

Current labor costs:

$$\frac{1.2 \times 0.68}{760} \times 6240 * 1740 = \$11,813/yr$$

New energy use

$$\frac{42\ W}{1000} * 24 * 260 * 0.03026 * 1740 = \$13,799/yr$$

New mat'l & labor costs:

$$\frac{16 + 6.45 * 0.68 * 1.2}{16,000} * 6240 * 1740 = \$14,429/yr$$

New labor costs

$$\frac{6.45 * 0.68 * 1.2}{16,000} * 6240 * 1740 = \$3572/yr$$

Radford Army Ammunition Plant
List of Buildings with Incandescent Lighting

Bldg No	Name/Process	Location	Similar	Fixtures/Bldg.	Total Fixtures
1000 -00	Cotton Linter Warehouse	NC, A&B-Line	1	17	17
1606 -00	Open Tank Air Dry	Sol. Recovery, A-Line	10	20	200
1611 -00	Solvent Recovery House	Sol. Recovery, B-Line	27	12	324
3513 -00	C-1 Press & Cutting House	Green, C-Line	3	20	60
4912 -27	SG Curing Hse.- Carpet Rolls	Cast Prop. (Rocket)	10	5	50
4924 -06	Machine and Saw House	Cast Prop. (Rocket)	1	6	6
7106 -04	Dry House #4 (Cure Grain)	1st R P	7	8	56
9334 -15	Blender House	4th Rolled Powder	1	4	4
TOTAL FOR EXTERIOR FIXTURES					717
420 -02	Acid Waste Disposal (C-Line)	Waste Acid	1	8	8
2019 -00	Boiling Tub House	NC, B-Line	3	50	150
2022 -00	Beater House	NC, B-Line	3	40	120
2024 -00	Poacher & Blending House	NC, B-Line	3	30	90
3513 -00	C-1 Press & Cutting House	Green, C-Line	3	50	150
4912 -40	Forced Air Dry House	Pilot B	21	10	210
4912 -11	LG Mold Loading House	Cast Prop. (Rocket)	2	6	12
4912 -03	MK 43 Sawing and Inhibiting	Cast Prop. (Rocket)	1	4	4
4915 -00	Small Grain Mold Assembly	Cast Prop. (Rocket)	1	7	7
4921 -00	Inspect/Clean NG Tanks *	Cast Prop. (Rocket)	1	21	21
4951 -02	TOW Launch Saw House	Pilot B	1	8	8
5008 -01	15 Inch Press House	Pilot A	3	2	6
6304 -00	Paste Blending House	1st R P	1	20	20
7113 -00	Roll House (Rolled Powder)	1st R P (F-Line)	1	130	130
9310 -02	Rolled Powder Building	4th Rolled Powder	2	300	600
TOTAL FOR INTERIOR FIXTURES					1536

CONSTRUCTION COST ESTIMATE	DATE PREPARED 6-90	SHEET 4 OF 10

PROJECT: ENERGY ENGINEERING ANALYSIS

LOCATION: RADFORD ARMY AMMUNITION PLANT

ARCHITECT ENGINEER: REYNOLDS, SMITH AND HILLS A.E.P., INC.

BASIS FOR ESTIMATE: ☒ CODE A (No design completed) ☐ CODE B (Preliminary design) ☐ CODE C (Final design) ☐ OTHER (Specify)

DRAWING NO.: GP-N-1

ESTIMATOR: T. Todd

CHECKED BY:

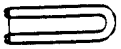
Incand. to 35WHPS SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
Replace incandescent	1740	fixt.	1.18	2053	45.00	78300	80353
lamps with 35W HPS							
screw-in retrofits							
Sales Tax	4.5%					3524	3524
FICA / Insurance	20.0%			411			411
Subtotal				2464		81824	84288
Overhead	15.0%						12643
Profit	10.0%						9693
Performance Bond	1.0%						1066
Hercules Support	6.0%						6461
Contingency	10.0%						11415
Construction Cost							125566

ECP ENERGY CONSERVATION PRODUCTS, 511 CANAL STREET, NYC, NY, 10013—TEL (212)-925-5991

POWER CONSUMPTION AND LUMEN OUTPUT DATA

WATTS	LINE WATTS	TOTAL LUMEN OUTPUT	LUMENS PER WATT	HOURS OF RATED LIFE
********* MERCURY VAPOR (DELUXE WHITE)				
1000	1075	63000	59	24000
400	450	23000	56	24000
250	290	13000	42	24000
175	205	8500	49	24000
100	120	4500	42	24000
75	93	3150	37	16000
50	61	1680	31	16000
********* METAL HALIDE				
1500	1600	155000	103	3000
1000	1100	110000	100	12000
400	460	34000	85	15000
175	210	14000	85	7500
********* HIGH PRESSURE SODIUM				
1000	1080	140000	130	24000
400	480	50000	104	24000
250	310	27500	89	24000
150	200	16000	80	24000
100	135	9500	70	24000
70	85	5800	68	24000
50	70	4000	57	24000
35	42	2850	67	18000
*********FLUORESCENT				
STRAIGHT 40	48	3150	66	20000+
CIRCLINE 32	37	1830	50	12000+
CIRCLINE 22	25	1050	42	12000+
CIRCLINE 20	23	850	37	12000+
TWIN TUBE 13	16	900	56	10000+
TWIN TUBE 9	12	600	50	10000+
STRAIGHT 8	11	400	36	7500+
TWIN TUBE 7	10	400	40	10000+
STRAIGHT 6	9	300	33	7500+
TWIN TUBE 5	8	250	31	10000+
********* INCANDESCENT				
1000	1000	23740	24	1000
750	750	17040	23	1000
500	500	10850	22	1000
200	200	3710	19	750
150	150	2880	19	750
100	100	1750	18	750
75	75	1190	16	750
******** QUARTS—IODINE				
1500	1500	35800	24	3000
1000	1000	23400	23	2000
500	500	10950	22	2600
250	250	4850	19	2000

RAPID START FLUORESCENT U LAMPS



LAMP	WATTAGE	APPX LUMENS	AVERAGE LIFE HRS.	STANDARD CASE QTY.
FB40/U6/CW/EW	34	2,600	12,000	12
FB40/U6/CW	40	2,950	12,000	12

INSTANT START SLIMLINE FLUORESCENT LAMPS

LAMP	WATTAGE	APPX LUMENS	AVERAGE LIFE HRS.	STANDARD CASE QTY.
F72T12/CW	55	4,550	12,000	12
F96T12/CW/EW	60	5,600	15,000	15
F96T12/CW	75	6,200	12,000	15

HIGH & VERY HIGH OUTPUT FLUORESCENT LAMPS

LAMP	WATTAGE	APPX LUMENS	AVERAGE LIFE HRS.	STANDARD CASE QTY.
F96T12/CW/HO/EW	95	8,300	12,000	15
F96T12/CW/HO	110	9,200	12,000	15
F96T12/CW/VHO/EW	185	14,000	12,000	15
F96T12/CW/VHO	215	15,500	12,000	15

METAL HALIDE UNIVERSAL BURN MEDIUM BASE LAMPS

LAMP	WATTAGE	APPX LUMENS	AVERAGE LIFE HRS.	STANDARD CASE QTY.
MH35/U	35	2,300	5,000	12
MH50/U	50	3,400	5,000	12
MH70/U	70	5,500	5,000	12
MH100/U	100	7,200	7,500	12
MH150/U	150	12,000	10,000	12

METAL HALIDE UNIVERSAL BURN MOGAL BASE LAMPS

LAMP	WATTAGE	APPX LUMENS	AVERAGE LIFE HRS.	STANDARD CASE QTY.
MH175/U	175	14,000	10,000	12
MH175/C/U	175	14,000	10,000	12
MH250/U	250	20,500	10,000	12
MH250/C/U	250	20,500	10,000	12
MH400/U	400	36,000	20,000	6
MH400/C/U	400	36,000	20,000	6
MH1000/U	1000	110,000	12,000	6
MH1000/C/U	1000	105,000	12,000	6

COMPACT DOUBLE ENDED HQI METAL HALIDE LAMPS

LAMP	WATTAGE	APPX LUMENS	AVERAGE LIFE HRS.	STANDARD CASE QTY.
HQI 70	70	5,000	10,000	12
HQI 150	150	11,000	10,000	12
HQI 250	250	19,000	10,000	12
HQI 400	400	25,000	10,000	12

HIGH PRESSURE SODIUM MEDIUM BASE LAMPS

LAMP	WATTAGE	APPX LUMENS	AVERAGE LIFE HRS.	STANDARD CASE QTY.
LU35/MED	35	2,250	16,000	12
LU35/D/MED	35	2,150	16,000	12
LU50/MED	50	4,000	24,000	12
LU50/D/MED	50	3,800	24,000	12
LU70/MED	70	6,300	24,000	12
LU70/D/MED	70	5,985	24,000	12
LU100/MED	100	9,500	24,000	12
LU100/D/MED	100	8,800	24,000	12
LU150/MED	150	16,000	24,000	12
LU150/D/MED	150	15,000	24,000	12

COLOR IMPROVED HIGH PRESSURE SODIUM LAMP

LAMP	WATTAGE	APPX LUMENS	AVERAGE LIFE HRS.	STANDARD CASE QTY.
NHT50SDX	50	2,500	12,000	12

HIGH PRESSURE SODIUM ED-23½ MOGUL BASE LAMPS

LAMP	WATTAGE	APPX LUMENS	AVERAGE LIFE HRS.	STANDARD CASE QTY.
LU50	50	4,000	24,000	12
LU50/D	50	3,800	24,000	12
LU70	70	6,300	24,000	12
LU70/D	70	5,985	24,000	12
LU100	100	9,500	24,000	12
LU100/D	100	8,800	24,000	12
LU150/55	150	16,000	24,000	12
LU150/55/D	150	15,000	24,000	12

HIGH PRESSURE SODIUM E-18 MOGUL BASE LAMPS

LAMP	WATTAGE	APPX LUMENS	AVERAGE LIFE HRS.	STANDARD CASE QTY.
LU200	200	22,000	24,000	12
LU250	250	29,000	24,000	12
LU250/D	250	26,000	24,000	12
LU310	310	37,000	24,000	12
LU400	400	50,000	24,000	12

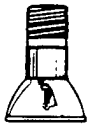
LOW PRESSURE SODIUM LAMPS

LAMP	WATTAGE	APPX LUMENS	AVERAGE LIFE HRS.	STANDARD CASE QTY.
SOX10	10	1,000	9,000	20
SOX18	18	1,800	14,000	20
SOX35	35	4,800	18,000	12
SOX55	55	8,000	18,000	9
SOX90	90	13,500	18,000	9
SOX135	135	22,500	18,000	9
SOX180	180	33,000	18,000	9

MR16 LOW VOLTAGE 12V TUNGSTEN HALOGEN LAMPS

LAMP	WATTAGE	APPX LUMENS	AVERAGE LIFE HRS.	STANDARD CASE QTY.
ESX (N)	20	3,300	2,000	20
BAB (W)	20	460	2,000	20
EYR (N)	42	7,300	2,000	20
EYS (M)	42	2,500	2,000	20
EYP (W)	42	1,200	2,000	20
EXT (N)	50	9,150	3,000	20
EXZ (M)	50	3,000	3,000	20
EXN (W)	50	1,500	3,000	20
EYF (N)	75	11,500	3,500	20
EYJ (M)	75	4,500	3,500	20
EYC (W)	75	2,000	3,500	20

MR16 LINE VOLTAGE 120V MEDIUM BASE TUNGSTEN HALOGEN LAMPS



LAMP	WATTAGE	APPX LUMENS	AVERAGE LIFE HRS.	STANDARD CASE QTY.
M/JDR75W/N	75	6,300	2,000	12
M/JDR75W/M	75	3,500	2,000	12
M/JDR75W/W	75	2,100	2,000	12
M/JDR100/N	100	8,500	2,000	12
M/JDR100/M	100	4,500	2,000	12
M/JDR100/W	100	3,000	2,000	12

MR16 LINE VOLTAGE 120V INTERMEDIATE BASE TUNGSTEN HALOGEN LAMPS

LAMP	WATTAGE	APPX LUMENS	AVERAGE LIFE HRS.	STANDARD CASE QTY.
I/JDR75W/N	75	6,300	2,000	12
I/JDR75W/M	75	3,500	2,000	12
I/JDR75W/W	75	2,100	2,000	12
I/JDR100/N	100	8,500	2,000	12
I/JDR100/M	100	4,500	2,000	12
I/JDR100/W	100	3,000	2,000	12

TUNGSTEN HALOGEN LINE VOLTAGE MEDIUM BASE TUBULAR LAMPS

LAMP	WATTAGE	APPX LUMENS	AVERAGE LIFE HRS.	STANDARD CASE QTY.
64484/CL	75	1,200	2,000	15
64484/FR	75	1,140	2,000	15
64486/CL	100	1,600	2,000	15
64486/FR	100	1,520	2,000	15
64488/CL	150	2,760	2,000	15
64488/FR	150	2,622	2,000	15

TUNGSTEN HALOGEN LINE VOLTAGE DOUBLE ENDED LAMPS

LAMP	WATTAGE	APPX LUMENS	AVERAGE LIFE HRS.	STANDARD CASE QTY.
Q100T3/CL	100	1,600	200	12
Q150T3/CL	150	2,800	200	12
Q200T3/CL	200	3,600	200	12
Q300T3/CL	300	6,000	200	12
Q500T3/CL	500	11,000	200	12
Q1500T3/CL	1500	33,000	200	12

166 100 | Lighting

			CREW	DAILY OUTPUT	MAN-HOURS	UNIT	BARE COSTS MAT.	BARE COSTS LABOR	BARE COSTS EQUIP.	BARE COSTS TOTAL	TOTAL INCL O&P	
140	1600	90 watt	1 Elec	.30	26.670	C	5.140	645		5,785	6,600	140
	1650	135 watt		.20	40		6.905	970		7,875	9,025	
	1700	180 watt		.20	40		7,308	970		8,278	9,475	
	1750	Quartz line, clear, 500 watt		1.10	7.270		1,872	175		2,047	2,325	
	1760	1500 watt		.20	40		3,427	970		4,397	5,200	
	1800	Incandescent, interior, A21, 100 watt		1.60	5		173	120		293	370	
	1900	A21, 150 watt		1.60	5		211	120		331	410	
	2000	A23, 200 watt		1.60	5		227	120		347	430	
	2200	PS 30, 300 watt		1.60	5		330	120		450	540	
	2210	PS 35, 500 watt		1.60	5		576	120		696	810	
	2230	PS 52, 1000 watt		1.30	6.150		1,525	150		1,675	1,900	
	2240	PS 52, 1500 watt		1.30	6.150		2,382	150		2,532	2,850	
	2300	R30, 75 watt		1.30	6.150		375	150		525	630	
	2400	R40, 150 watt		1.30	6.150		408	150		558	670	
	2500	Exterior, PAR 38, 75 watt		1.30	6.150		566	150		716	840	
	2600	PAR 38, 150 watt		1.30	6.150		525	150		675	795	
	2700	PAR 46, 200 watt		1.10	7.270		1,928	175		2,103	2,375	
	2800	PAR 56, 300 watt		1.10	7.270		2,193	175		2,368	2,675	
	3000	Guards, fluorescent lamp, 4' long		1	8		375	195		570	695	
	3200	8' long		.90	8.890		535	215		750	905	
145	0010	RESIDENTIAL FIXTURES										145
	0400	Fluorescent, interior, surface, circline, 32 watt & 40 watt	1 Elec	20	.400	Ea.	48	9.70		57.70	67	
	0500	2' x 2', two U 40 watt		8	1		66	24		90	110	
	0700	Shallow under cabinet, two 20 watt		16	.500		45	12.15		57.15	67	
	1900	Wall mounted, 4'L, one 40 watt, with baffle		10	.800		41	19.40		60.40	74	
	2000	Incandescent, exterior lantern, wall mounted, 60 watt		16	.500		36	12.15		48.15	57	
	2100	Post light, 150W, with 7' post		4	2		104	49		153	185	
	2500	Lamp holder, weatherproof with 150W PAR		16	.500		16	12.15		28.15	35	
	2550	With reflector and guard		12	.667		31	16.15		47.15	58	
	2600	Interior pendent, globe with shade, 150 watt		20	.400		78	9.70		87.70	100	
150	0010	TRACK LIGHTING										150
	0080	Track, 1 circuit, 4' section	1 Elec	6.70	1.190	Ea.	33	29		62	79	
	0100	8' section		5.30	1.510		48	37		85	105	
	0200	12' section		4.40	1.820		81	44		125	155	
	0300	3 circuits, 4' section		6.70	1.190		36	29		65	82	
	0400	8' section		5.30	1.510		48	37		85	105	
	0500	12' section		4.40	1.820		88	44		132	160	
	1000	Feed kit, surface mounting		16	.500		12	12.15		24.15	31	
	1100	End cover		24	.333		1.98	8.10		10.08	14.05	
	1200	Feed kit, stem mounting, 1 circuit		16	.500		16	12.15		28.15	35	
	1300	3 circuit		16	.500		16	12.15		28.15	35	
	2000	Electrical joiner for continuous runs, 1 circuit		32	.250		6.55	6.05		12.60	16.10	
	2100	3 circuit		32	.250		12.10	6.05		18.15	22	
	2200	Fixtures, spotlight, 150 PAR		16	.500		47	12.15		59.15	70	
	3000	Wall washer, 250 watt tungsten halogen		16	.500		101	12.15		113.15	130	
	3100	Low voltage, 25/8 watt, 1 circuit		16	.500		102	12.15		114.15	130	
	3120	3 circuit		16	.500		109	12.15		121.15	140	

166 100 | Lighting

			CREW	DAILY OUTPUT	MAN-HOURS	UNIT	BARE COSTS MAT.	BARE COSTS LABOR	BARE COSTS EQUIP.	BARE COSTS TOTAL	TOTAL INCL O&P	
135	5100	175 watt metal halide	1 Elec	8	1	Ea.	479	24		503	565	135
	5110	250 watt metal halide		8	1		500	24		524	585	
	5120	150 watt high pressure sodium		8	1		535	24		559	625	
	5130	250 watt high pressure sodium		8	1		556	24		580	645	
	5140	72"H 18" sq., 400 watt metal halide		8	1		525	24		549	615	
	5150	250 watt high pressure sodium		8	1		556	24		580	645	
	5160	400 watt high pressure sodium		8	1		581	24		605	675	
	5190	Portable rectangle, 6" high 13.5" x 20"										
	5200	175 watt metal halide	1 Elec	12	.667	Ea.	293	16.15		309.15	345	
	5210	250 watt metal halide		12	.667		314	16.15		330.15	370	
	5220	150 watt high pressure sodium		12	.667		335	16.15		351.15	390	
	5230	250 watt high pressure sodium		12	.667		360	16.15		376.15	420	
	5240	8" high 18" x 24", 400 watt metal halide		12	.667		365	16.15		381.15	425	
	5250	250 watt high pressure sodium		12	.667		376	16.15		392.15	435	
	5260	400 watt high pressure sodium		12	.667		398	16.15		414.15	460	
	5270	Portable square, 15" high 13.5" sq., 175 watt metal halide		12	.667		324	16.15		340.15	380	
	5280	250 watt metal halide		12	.667		376	16.15		392.15	435	
	5290	150 watt high pressure sodium		12	.667		360	16.15		376.15	420	
	5300	250 watt high pressure sodium		12	.667		386	16.15		402.15	450	
	5400	Pendent 16" round/square, 175 watt metal halide		3.20	2.500		355	61		416	480	
	5410	250 watt metal halide		2.70	2.960		370	72		442	515	
	5420	400 watt metal halide		2.40	3.330		398	81		479	555	
	5430	150 watt high pressure sodium		3.20	2.500		398	61		459	525	
	5440	250 watt high pressure sodium		2.70	2.960		428	72		500	575	
	[illegible]0	400 watt high pressure sodium		2.40	3.330		454	81		535	620	
140	0010	LAMPS										140
	0080	Fluorescent, rapid start, cool white, 2' long, 20 watt	1 Elec	1	8	C	348	195		543	670	
	0100	4' long, 40 watt		.90	8.890		198	215		413	535	
	0120	3' long, 30 watt		.90	8.890		442	215		657	805	
	0150	U-40 watt		.80	10		874	245		1,119	1,325	
	0170	4' long, 35 watt energy saver		.90	8.890		270	215		485	615	
	0200	Slimline, 4' long, 40 watt		.90	8.890		618	215		833	995	
	0300	8' long, 75 watt		.80	10		577	245		822	990	
	0350	8' long, 60 watt energy saver		.80	10		603	245		848	1,025	
	0400	High output, 4' long, 60 watt		.90	8.890		750	215		965	1,150	
	0500	8' long, 110 watt		.80	10		775	245		1,020	1,200	
	0520	Very high output, 4' long, 110 watt		.90	8.890		1,285	215		1,500	1,725	
	0550	8' long, 215 watt		.70	11.430		1,285	275		1,560	1,825	
	0600	Mercury vapor, mogul base, deluxe white, 100 watt		.30	26.670		2,142	645		2,787	3,300	
	0650	175 watt		.30	26.670		1,663	645		2,308	2,775	
	0700	250 watt		.30	26.670		2,968	645		3,613	4,225	
	0800	400 watt		.30	26.670		2,340	645		2,985	3,525	
	0900	1000 watt		.20	40		5,100	970		6,070	7,025	
	1000	Metal halide, mogul base, 175 watt		.30	26.670		3,749	645		4,394	5,075	
	1100	250 watt		.30	26.670		4,712	645		5,357	6,125	
	1200	400 watt		.30	26.670		4,386	645		5,031	5,775	
	1300	1000 watt		.20	40		9,894	970		10,864	12,300	
	1320	1000 watt, 125,000 initial lumens		.20	40		9,960	970		10,930	12,400	
	1330	1500 watt		.20	40		9,268	970		10,238	11,600	
	[illegible]50	Sodium high pressure, 70 watt		.30	26.670		4,712	645		5,357	6,125	
	[illegible]60	100 watt		.30	26.670		4,871	645		5,516	6,300	
	1370	150 watt		.30	26.670		5,059	645		5,704	6,525	
	1380	250 watt		.30	26.670		5,380	645		6,025	6,875	
	1400	400 watt		.30	26.670		5,727	645		6,372	7,250	
	1450	1000 watt		.20	40		13,352	970		14,322	16,100	
	1500	Low pressure, 35 watt		.30	26.670		3,963	645		4,608	5,300	
	1550	55 watt		.30	26.670		4,386	645		5,031	5,775	

HUNTER **Telephone Call Confirmation**

Project No. 290 0379 000

Local _____ L.D. (718) 851-4577 Placed ✓ Rec'd. ✓ Date 6-7-90

T. Todd Conversed With Mr. Singer

Of American Scientific Lighting Co. Regarding HPS retrofits

For retrofits of incandescent fixtures, the "Bulb Lumenight" and "Colorlight" products are recommended. The lamps are replaceable in both, and the "colorlight" is more whitish. Contractors costs (including lamps) for quantities of 100+ are as follows:

Bulb Lumenight	35 W	$45	(lamps only $16 - $20)
	50 W	$45	

(also come in 70 W, 100 W, 150 W)

Colorlight	50 W	$67	(lamps only $30)

They will send a copy of their catalog for dimensions.

Distribution:

FLUOR-A-LAMP™ SERIES: *COMPACT FLUORESCENT LAMPS*

GLOBE LAMP/LUMA LAMP

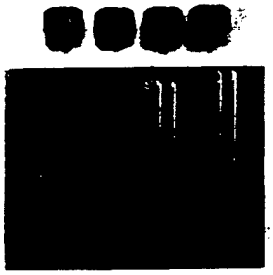
- **LAMP:** Compact disposable fluorescent globe or tubular lamp/standard or tapered base
- **WATTAGE:** Fifteen
- **LUMENS:** 720
- **COLOR:** Warm white/2800k
- **USE:** Indoor only
- **BURNING POSITION:** Any
- **LAMP LIFE:** 9,000 hours
- **INSTALLATION:** Screws into any 120V medium base socket
- **PACKAGING:** Ten lamps per master carton

CATALOG NUMBER	LAMP	DIMENSIONS
FGL S/15	BFG15 LE/A	Lamp Diameter 3¾" Overall Length 6¼"
FGL T/15	BFG15 LE/T	Lamp Diameter 3¾" Overall Length 6¾"
FLL S/15	BFT15 LE/A	Lamp Diameter 3⅛" Overall Length 6⅜"
FLL T/15	BFT15 LE/T	Lamp Diameter 3⅛" Overall Length 7"

CONVERT-A-LITE™ SERIES: *SCREW-IN FLUORESCENT ADAPTER CONVERSIONS*

ECONOMY CUP CONVERSION

- **ADAPTER:** Molded Noryl® thermal plastic/Sealed and potted to protect internal components
- **FINISH:** White
- **LAMP:** Centered on top of adapter/Not dimmable
- **INSTALLATION:** Adapter screws into any standard 120v medium based socket/No additional wiring or modified circuitry required
- **PACKAGING:** Bulk packed/Lamp included



PREMIUM CUP CONVERSION

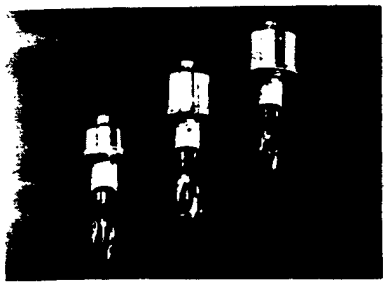
- **ADAPTER:** Molded Noryl® thermal plastic/Sealed to protect internal components
- **FINISH:** Black
- **LAMP:** Centered/Recessed inside of adapter/Not dimmable
- **INSTALLATION:** Adapter screws into any standard 120v medium base socket/No additional wiring or modified circuitry required/Ratched screw base prevents over tightening
- **PACKAGING:** Bulk packed/Lamp included

CATALOG NUMBER	LAMP	DIMENSIONS
		Adapter Diameter 2⅛"
CC/5/E	PL5	**Overall Length 6⅜"**
CC/7/E	PL7	**Overall Length 7½"**
CC/9/E	PL9	**Overall Length 8⅜"**
CC/13/E	PL13	Overall Length 9 1/16"
CC/Q9/E	Quad 9	**Overall Length 6⅜"**
CC/Q13/E	Quad 13	**Overall Length 7"**

CATALOG NUMBER	LAMP	DIMENSIONS
		Adapter Diameter 2¾"
CC/5/P	PL5	Overall Length 5½"
CC/7/P	PL7	Overall Length 6 13/16"
CC/9/P	PL9	Overall Length 8"
CC/13/P	PL13	Overall Length 8 13/16"
CC/Q9/P	QUAD 9	Overall Length 5⅞"
CC/Q13/P	QUAD 13	Overall Length 6¼"
CC/Q22/P	QUAD 22	Overall Length 8⅝"
CC/Q28/P	QUAD 28	Overall Length 9⅛"

PREMIUM OPTIONS:
DWC Direct Wire—Center **SWS** Direct Wire—Side

CONVERT-A-LITE™ SERIES: *SCREW-IN HPS ADAPTER CONVERSIONS*



BULB LUMENIGHT™

- **ADAPTER:** Heavy gauge spun aluminum
- **FINISH:** Caustic etching
- **INSTALLATION:** Adapter screws into a standard 120V medium base porcelin socket/No additional wiring or modified circuitry required/Safety weight ground wire
- **PACKAGING:** Four per carton/Lamp included

CATALOG NUMBER	LAMP	DIMENSIONS
BL/35	LU35	Diameter 3⅛"
BL/50	LU50	Overall Length 9⅜"
BL/70	LU70	Diameter 3¼" Overall Length 10 1/16"
BL/100	LU100	Diameter 4"
BL/150	LU150	Overall Length 10⅛"

OPTIONS:
HBR High Bay Reflector **DW** Direct Wire
LBR Low Bay Reflector

AMERICAN SCIENTIFIC LIGHTING CORPORATION · BROOKLYN, NEW YORK · TEL. (800) 522-3465 · (718) 851-4577 · FAX (718) 853-2390

DOCUMENTATION FOR PRODUCTIVITY CAPITAL INVESTMENT PROGRAMS
For use of this form, see AR 5-4; the proponent agency is OCA.

1. PROJECT NO.

REQUIREMENT CONTROL SYMBOL DD-M(R) 1561

2. TO: HQ. DA (EACA-RMP)
Rm 3B719 (Pentagon)
Washington, DC 20310-2070

3. THRU: CDR, AMC (AMCRM-MP)
5001 Eisenhower Avenue
Alexandria, VA 22333-0001

4. FROM: CDR, AMCCOM
Attn: AMSMC-MGP-P (R)
Rock Island, IL 61299-6000

5. DOD COMP NAME: Army

6. DOD COMP CODE: A

7. COMMAND CODE: W730KK

8. DATE:

9. PROJECT TITLE
Change Incinerator Fuel to Natural Gas (ECO GP-X-6)

10. TYPE OF PROJECT (Check one)
☐ QRIP ☒ OSD PIF ☐ PECIP

11. AMORTIZATION YEARS/MONTHS
$ 250,875 (Project Cost) ÷ 78 457 (Average Annual Savings) X 12 (No. Mos)
= 3.2 (years) or -- (months) (amortization)

12. FUNCTIONAL AREA WHERE SAVINGS WILL OCCUR
024

13. ECONOMIC LIFE

14. EXPECTED OPERATIONAL DATE

15. SUBMITTING UNIT(S)
Administrative Contracting Office
Radford Army Ammunition Pt
Radford, VA 24141

16. UNIT ID CODE
WOLLAA

17. PROJECT DESCRIPTION
Install a natural gas line to the waste propellant incinerators to replace #2 fuel oil as combustion fuel.

18. DETAILED JUSTIFICATION
Currently #2 fuel oil is used to incinerate the waste propellant generated at Radford AAP. Extending the existing natural gas line to the incinerator is more economic due to the lower cost of natural gas on a Btu basis.

19. SAVINGS DISPOSITION
Cost savings will reduce utility bills.

20. OTHER REMARKS (Continue on page 5, if more space is needed)

21a. SUMMARY OF DOLLAR SAVINGS
(ROUND OFF TO THE NEAREST DOLLAR)

Attach computation sheet identifying the method and source of data for savings

SAVINGS BREAKOUT	PRESENT METHOD	PROPOSED METHOD				DIFFERENCE/SAVINGS			
		1ST YR	2D YR	3D YR	4TH YR	1ST YR	2D YR	3D YR	4TH YR
SALARY/LABOR/ OVERTIME									
MATERIAL/ SUPPLIES									
UTILITIES									
MAINTENANCE/ REPAIR									
TRANSPORTATION									
LEASE COSTS									
SALVAGE/ TURN-IN									
ENERGY (Identify) Fuel Oil	368,146	289,689	289,689	289,689	289,689	78,457	78,457	78,457	78,457
CONTRACT COSTS									
OTHER (Identify)									
TOTALS	368,146	289,689	289,689	289,689	289,689	78,457	78,457	78,457	78,457

b. PRIORITIZATION

(1) INTERNAL RATE OF RETURN (IRR)

Divide estimated project cost 250,875 by average annual savings 78,457 = 3.2 factor.

Based on factor and number of years economic life of the project, select the IRR from Table H-3, App H, Ch. 5, AR 5-4 = 37 % IRR.

(2) SAVINGS TO INVESTMENT RATIO (S/I)

Multiply annual savings 78,457 X discount factor 15.36 = 1,205,227 and divide by present value of investment (undiscounted) 250,875 = 4.8 S/I.

(Based on economic life 25 years, select discount factor from Table H-4, App H, Ch. 5, AR 5-4.

(3) RATE OF INVESTMENT PER MANPOWER SPACE (RIMS) NA

Divide estimated project cost _____ by number of manpower space savings _____ = _____ RIMS.

(Manpower requirements cannot be used in this computation.)

22. COST FOR PROJECT TO BECOME OPERATIONAL

EQUIPMENT TYPE a	PROPOSED SOURCE OF PROCUREMENT b	UNIT PRICE c	QUANTITY d	TOTAL COST e	APPROPRIATION, BUDGET ACTIVITY OR PROGRAM ELEMENT f	FY FUNDS REQUIRED g
(1) Natural Gas Line		250,875	1	250,875		
(2)						
(3)						
(4)						
(5)						
(6) TRANSPORTATION (*Equipment delivery*)						
(7) EQUIPMENT MODIFICATION[1]						
(8) EQUIPMENT INSTALLATION						
(9) MAINTENANCE CONTRACT[2]						
(10) FACILITIES MODIFICATION[3]						
(11) TRAINING						
(12) OTHER (*Specify*):						
(13) TOTAL REQUIRED FOR PROJECT TO BECOME OPERATIONAL[4]				250,875		
(14) TOTAL AMOUNT OF FUNDING REQUESTED IN THIS PROPOSAL				250,875		
(15) TOTAL AMOUNT OF FUNDING REQUIRED FROM OTHER SOURCE[5]				--		
(16) TOTAL (*Sum of (14) + (15) above*)				250,875		

[1] *Not to exceed 10% of equipment cost for QRIP projects.*

[2] *Applicable to OPA QRIP provided cost is included in packaged deal involving one bill for the equipment and initial maintenance.*

[3] *Normally not OPA funded.*

[4] *Used to compute amortization in Item 11.*

[5] *Specify source to include certification that funds are available, if financed from the regular budget:*

23. SUMMARY OF SAVINGS *(MANPOWER AND DOLLARS)*

ITEMS	SAVINGS			REAPPLICATION OF SAVINGS					
	NO. MPR OR MHR	TYPE PERS[6]	DOLLARS	PROGRAM ELEMENT		TDA PARA AND LINE		FUNCTION CODE	
a	b	c	d	e. FROM	f. TO	g. FROM	h. TO	i. FROM	j. TO
(1) REQUIREMENTS AND AUTHORIZATIONS ELIMINATED									
(2) REQUIREMENTS ONLY ELIMINATED									
(3) BORROWED MILITARY MANPOWER RELEASED									
(4) OVERHIRES OR TEMPORARIES TERMINATED									
(5) HOURS OVERTIME ELIMINATED									
(6) MANHOURS SAVED FROM MULTIPLE POSITIONS[7]									
(7) OTHER DOLLAR SAVINGS *(Excluding Manpower)*, e.g., CONTRACT COSTS & UTILITIES			74,457						
(8)									
(9)									
(10)									
(11) TOTAL DOLLAR SAVINGS			74,457						

[6] *(1) US Graded*
(2) US Wage Board
(3) DHFN
(4) IHFN
(5) Officer
(6) WO
(7) Enlisted

[7] *Reflect specific duties being performed with additional manhours available (equivalent manyears)*

24. REGULATORY APPROVAL/COORDINATION

a. INVESTMENT STATEMENT

This proposal has been reviewed and it cannot be implemented with existing equipment or facilities. This investment is in accordance with established investment planning. The project complies with public laws, OSD policies and regulations, and all other regulatory constraints.

_____

(Cite regulatory approvals, e.g., TAGO Control No.) (Ex. New Start, TAGO Approval, etc.)

b. OTHER COORDINATION *(Functional Coordination at local level, e.g., Fac Eng, Log, Pers, etc.)*

_____

_____

25. SUBMITTED BY *(Typed name, grade and title of Subordinate Command/Agency or Project Initiator)*	SIGNATURE	DATE *(YYMMDD)* AUTOVON
26. APPROVAL RECOMMENDED BY *(MACOM/Agency)*	SIGNATURE	DATE *(YYMMDD)* AUTOVON

FOR USE BY HQDA ON OSD PIF PROJECTS ONLY

27. APPROVED BY	SIGNATURE	DATE *(YYMMDD)* AUTOVON

28. OTHER REMARKS *(Cont'd)*

Figure H–1 Documentation for Productivity Capital Investment Program (DA Form 5108–R)—Continued.

RS&H®

SUBJECT _____ AEP NO _____

SHEET _____ OF _____

DESIGNER G. FALLON DATE 6/14/90

CHECKER P. HUTCHINS DATE 6/14/90

ECO # GP-X-6 CHANGE INCINERATOR FUEL TO NAT. GAS

INCINERATOR FUEL COST SAVINGS

FUEL OIL SAVINGS = 86,217 MBTU/yr

NAT GAS INCREASE = 86,217 MBTU/yr

"

Current energy costs:

86,217 * 4.27 = $368,146/yr.

New energy costs:

86,217 * 3.36 = $289,689/yr.

Savings = $78,457/yr.

HUNTER **Telephone Call Confirmation**

Project No. 290-0379-000

Local ____ L.D. X Placed X Rec'd. ____ Date 5-31-90

G. F. Conversed With Pat FEEK

Of Radford (U.S. Gov't) Regarding Gas line for incinerator

Incinerator Gas line - Past study citation.
Date of Study - ~~'87~~ '86
Scope of work - ie: Incinerator Burners new? NO!
Total installed cost - $142,960 +
Any Energy Savings? - (NO.)
How much - ?
"Put or Pay" contract with gas company is under negotiation and proceeding slowly.

Original $87-130,000/yr. savings.

200-250K ~~total~~ installed cost.

Because of fuel oil and natural gas price fluctuation Radford projects a 25-30% cost saving to switch to natural gas.

Distribution:

ECAM

ECO Number: FN-U-1

COVER THE WATER DRY TANKS WITH HOLLOW PLASTIC SPHERES

Description

The water dry process is used to remove residual ether and alcohol left in the propellant after the solvent recovery process. Open tanks filled with water heated to 149f are used to purge the solvents from the propellant. These tanks are about nine feet high and have a diameter of 16 feet. Approximately 730 MBtu per year of heat is lost from the surface of each water dry tank. Over 86 percent of these losses is due to evaporation and the remainder is conduction.

The surface heat loss can be significantly reduced by adding a layer of two-inch hollow plastic spheres. These spheres would reduce the exposed surface area (the driving force for evaporation) by 85 percent and also improve the U-value of the surface by a factor of two.

Recommendations

Based on the Life Cycle Cost Analysis, it is recommended that two-inch hollow plastic spheres be used on the surface of the water dry tanks.

Construction Cost	=	$49,899
Annual Energy Savings (coal)	=	14,421 MBtu
Annual Energy Cost Savings	=	$23,218
Additional Purchased Electricity	=	$ 9,143
Reduced Power House O&M	=	$9,379
Net Cost Savings	=	$23,454
SIR	=	4.68
Simple Payback	=	2.14 years

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: BALLS
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID 1.035
INSTALLATION & LOCATION: RADFORD AAP — REGION NOS. 3 CENSUS: 3
PROJECT NO. & TITLE: FN-U-1 COVER WATER DRY TANK WITH PLASTIC BALLS
FISCAL YEAR 1990 DISCRETE PORTION NAME: WATER DRY TANKS
ANALYSIS DATE: 10-02-90 ECONOMIC LIFE 15 YEARS PREPARED BY: W. TODD

1. INVESTMENT

A. CONSTRUCTION COST	$ 49899.
B. SIOH	$ 2745.
C. DESIGN COST	$ 2994.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9	$ 50074.
E. SALVAGE VALUE COST	-$ 0.
F. TOTAL INVESTMENT (1D-1E)	$ 50074.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 8.87	0.	$ 0.	8.78	0.
B. DIST	$ 4.27	0.	$ 0.	12.34	0.
C. RESID	$ .00	0.	$ 0.	12.05	0.
D. NAT G	$ .00	0.	$ 0.	12.48	0.
E. COAL	$ 1.61	14421.	$ 23218.	10.01	232410.
F. TOTAL		14421.	$ 23218.		$ 232410.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		$ 236.
(1) DISCOUNT FACTOR (TABLE A)	9.11	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		$ 2150.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3Bd4)		$ 2150.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 76695.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)= _____
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) $ 23454.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 234560.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 4.68
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 2.14

REYNOLDS, SMITH AND HILLS
ARCHITECTS • ENGINEERS • PLANNERS
INCORPORATED

SUBJECT RAAP EEAP
Cover Water Dry Tank Surface
DESIGNER W. T. Todd
CHECKER P. Hutchins

AEP NO
SHEET 1 OF
DATE 6-4-90
DATE 6/12/90

ECO# FN-U-1

COVER WATER DRY TANK SURFACE WITH SPHERES

Assumptions:

1. Heat losses due to radiation from the tank are neglected due to the low temperature difference and being indoors.

2. Heat losses due to convection from the tank are neglected due to the still air conditions in the building.

3. The average room conditions are 70 °F db, 60 % RH, 56°F dew point.

4. The tank temperature is 149°F. Waterland & Viar, Industrial Steam System Analysis for RAAP.

5. The tank diameter is 16 Feet. RAAP building inventory printout.

6. The evaporation rate is given by the following equation:

$$\dot{m}_{evap}\left(\frac{lb}{hr}\right) = \frac{A\,(95 + 0.425\,v)}{Y}\,(P_w - P_a)$$

ASHRAE HVAC Systems Handbook, 1987, page 20.8.

Calculations:

Area of surface $= \pi r^2 = \pi \times (8\,ft)^2 = 201\,ft^2$

$Q_{conduction} = UA\,\Delta T$

$Q_{EVAPORATION} = \dot{m}\,(C_{vap} + C_p * \Delta T)$

Plastic Spheres (Continued):

$U_{Top} = 1/R_{Air} = 1/0.68 = 1.47$ Btu/hr·ft²·°F

$\Delta T = 149°F - 70°F = 79°F$

$Y = h_{fg}$ = heat of vaporization @ 149°F = 1008.3 Btu/lb — ASHRAE FUND. Table 4, p. 6.15

$C_p = 1$ Btu/lb·°F

V = air velocity = 1 ft/min

p_w = Sat. Vapor Press. @ 149°F ≈ p_s = 7.394 in.Hg. — ASHRAE Fund. Table 2, p. 6.8

p_a = Sat. Vapor Press. @ 56°F (d.pt.) = 0.452 in.Hg. — ASHRAE Fund. Table 2, p. 6.6

$$\dot{m}_{evap} = \frac{201\,(95 + 0.425 \times 1)}{1008}(7.394 - 0.452) = (\text{lb/hr})$$

$\dot{m}_{evap} = 132$ lb/hr

$$\text{FY 89 WD cycles} = \frac{181 \text{ FY 88 WD cycles}}{12 \times 10^6 \#NC} \times 25 \times 10^6 \#NC = 377$$

377 WD Cycles ÷ 15 Active bldgs ÷ 2 tanks/bldg = 12.6 $\frac{\text{cycles}}{\text{tank}}$

FY 88 cycles/tank = 181 WD cycles ÷ 8 bldgs ÷ 2 tanks ea = 11.3

Use ~ 12 WD cycles/tank per year

$$\text{Average cycle time} = \frac{65000 \text{ hours}}{181 \text{ cycles}} \times \frac{1 \text{ day}}{24 \text{ hrs}} = 15 \frac{\text{days}}{\text{cycle}} = 360 \frac{\text{hrs}}{\text{cycle}}$$

12 cyc/yr × 360 hr/cycle = 4320 hours/yr

Plastic Spheres (Continued):

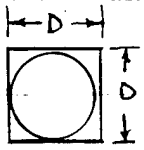
$$Q_{cond} = 1.47 \frac{Btu}{hr \cdot ft^2 \cdot ^\circ F} \times 201 ft^2 \times 79^\circ F \times 4320 \frac{hrs}{yr} = \underline{100.8\ MBtu/yr}$$

$$Q_{Evap} = 132 \frac{lb}{hr} \times 4320 \frac{hr}{yr} \times \left[1008.3 \frac{Btu}{lb} + 1 \frac{Btu}{lb\ ^\circ F} \times (149-53)^\circ F\right]$$

$$Q_{Evap} = 570{,}240 \frac{lb}{yr} \times \left(1008.3 \frac{Btu}{lb} + 96 \frac{Btu}{lb}\right) = \underline{629.7\ MBtu/yr}$$

Exposed Surface Area Reduction By Addition of Plastic Spheres:

minimum:



$$\frac{\text{area of circle}}{\text{area of square}} = \frac{\pi D^2/4}{D \times D} = \pi/4 = 0.785$$

Maximum = 0.884 (See attached calculations)

Use 0.85

Assume 2" plastic spheres with a 1.5" air space

Neglect R-Value of plastic

Minimum $R_{Air\ space} = 0.77 \frac{ft^2 \cdot hr \cdot ^\circ F}{Btu}$ 1981 ASHRAE Fund. Page 23.13, Table 2

$$U_{spheres} = 1/R_T = \frac{1}{R_{Air} + R_{Film}} = \frac{1}{.77 + .68} = 0.69\ Btu/Hr \cdot ft^2 \cdot ^\circ F$$

$$U_{surface} = 0.85 \times 0.69 \frac{Btu}{hr \cdot ft^2 \cdot ^\circ F} + 0.15 \times 1.47 \frac{Btu}{hr \cdot ft^2 \cdot ^\circ F} = 0.81\ Btu/hr \cdot ft^2 \cdot ^\circ F$$

Plastic Spheres (Continued):

$$Q_{cond\text{-}new} = UA\Delta T = 0.81 \frac{Btu}{hr\text{-}Ft^2 °F} \times 201 Ft^2 \times 79 °F \times 4320 \frac{hr}{yr}$$

$$= 55.6 \ MBtu/yr$$

$$Q_{Evap\text{-}new} = Q_{Evap} \times (1 - 0.85) = 629.7 \frac{mBtu}{hr} \times 0.15$$

$$= 94.5 \ mBtu/yr$$

Steam Savings:

$$Savings = (Q_{old} - Q_{new}) * No. Tanks$$

$$= \left[(100.8 + 629.7) \frac{mBtu}{yr} - (55.6 + 94.5) \frac{mBtu}{yr}\right] * 2 \frac{Tanks}{bldg} * 8 \ bldg$$

$$Savings = 9286.4 \ mBtu/yr$$

Coal Savings:

$$Savings = Steam\ Savings * \frac{steam\ savings}{factor} \div Dist.\ losses$$

$$Energy = 9286.4 \frac{mBtu}{yr} * 1.32 \div 0.85 = \underline{14{,}421.2 \frac{mBtu}{yr}}$$

$$Cost = 14{,}421.2 \frac{mBtu}{yr} \times 1.61 \ \$/mBtu = \underline{\$23{,}218/yr}$$

Electric Purchase Effect:

$$Cost\ Increase = 9286.4 \frac{mBtu_s}{yr} \times 0.111 \frac{mBtu_e}{mBtu_s} \times \$8.87/mBtu_e = \underline{\$9143/yr}$$

Non-Energy Costs:

$$\$1.01 * 9286.4 = \underline{\$9379/yr}$$

Plastic Spheres (Continued):

Non-Energy Savings = $9379 - 9143 = $236/yr.

Cost Savings:

Savings = Coal $ Savings − Elec $ increase + Non energy $

= (23,218 − 9143 + 9379) $/yr = $23,454/yr

Construction Cost:

Project Cost = $49,899 See Construction Cost Estimate Sheet.

2" polypropylene or HDPE hollow spheres

$500 \frac{\text{balls}}{\text{case}} \times \frac{\pi D^2}{4} \times \frac{1 ft^2}{144 in^2} = 500 \times \frac{\pi}{144} ft^2/\text{case} = 10.9 ft^2/\text{case}$

$10.9 ft^2/\text{case} \div 0.85 (\%\ \text{coverage}) = 12.8 ft^2$ coverage per case

$201 ft^2 \div 12.8 ft^2/\text{case} = 15.7 \Rightarrow 16$ cases/tank

Simple Payback

Payback = Cost ÷ Savings

= $49,899 ÷ $23,454/yr = 2.1 years

Non energy savings = $9286.4 \frac{\text{MBtu}}{\text{yr}} \times 1.01 \frac{\$}{\text{MBtu}} = \$9379$

CONSTRUCTION COST ESTIMATE	DATE PREPARED June 4, 1990	SHEET 6 OF

PROJECT: ENERGY ENGINEERING ANALYSIS

LOCATION: RADFORD ARMY AMMUNITION PLANT

ARCHITECT ENGINEER: REYNOLDS, SMITH AND HILLS A.E.P., INC.

BASIS FOR ESTIMATE
- [x] CODE A (No design completed)
- [ ] CODE B (Preliminary design)
- [ ] CODE C (Final design)
- [ ] OTHER (Specify) _____

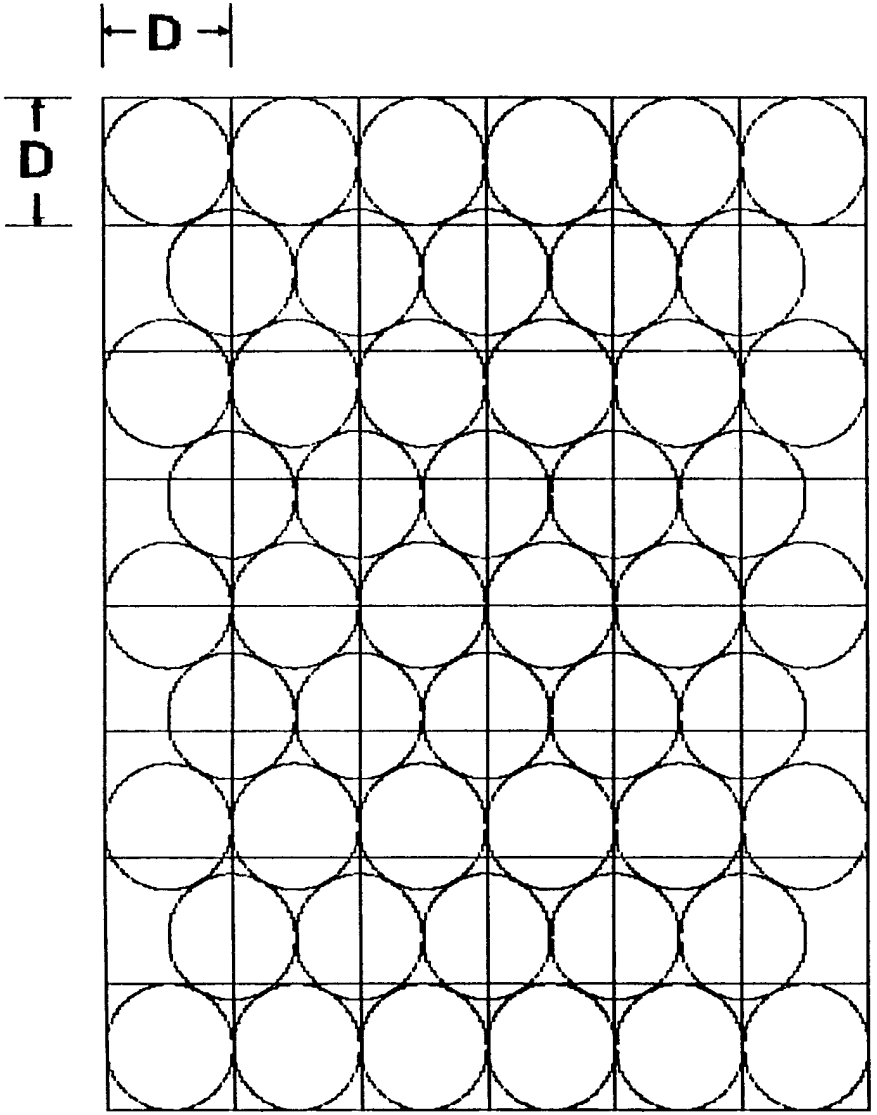
DRAWING NO.: NA

ESTIMATOR: W. T. Todd

CHECKED BY: K. Hutchins

Plastic Balls SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
2" Plastic balls	16	Case	2.50	40.00	123	1968.00	2008.00
Subtotal				40.00		1968.00	2008.00
Location Adjustments			0.683	(12.68)	1.002	3.94	(8.74)
Sales Tax					4.5%	88.74	88.74
FICA / Insurance			20%	5.46			5.46
Subtotal							2093.46
Overhead	15%						314.02
Profit	10%						240.75
Performance Bond	1%						26.48
RAAP Support	6%						160.48
Contingency	10%						283.52
Construction Cost	per	Tank					3118.71
			8 buildings x 2		tanks / bldg		x 16
Total Construction Cost							$49,899.36

Source: Vendor Quote from Mid-America Plastics, Shakopee, MN



A_s = Surface Area = $6D \times 8D$

A_c = Circle Areas = $6 \times 9 \times \frac{\pi D^2}{4}$

C = % Coverage = $\frac{A_c}{A_s} \times 100$

$$C = \frac{6 \times 9 \times \frac{\pi D^2}{4}}{6D \times 8D} \times 100$$

$$C = \frac{9 \times \pi}{4 \times 8} \times 100 = \frac{9\pi}{32} \times 100$$

$$C = 88.4\%$$

Cover Water Dry Tanks

R S H 38 (3-63)

Water Dry House

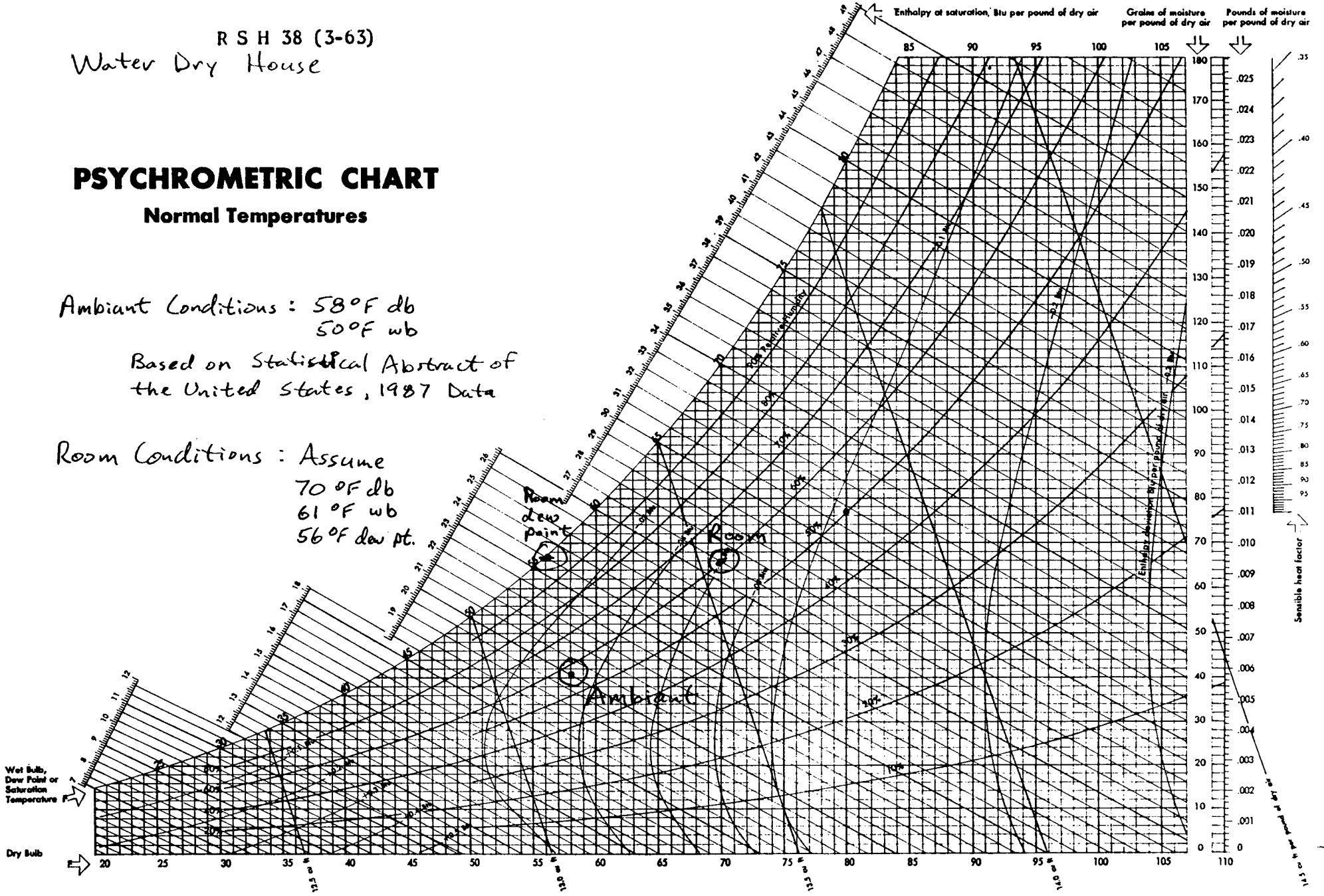
PSYCHROMETRIC CHART

Normal Temperatures

Ambiant Conditions : 58°F db
50°F wb

Based on Statistical Abstract of the United States, 1987 Data

Room Conditions : Assume
70 °F db
61 °F wb
56 °F dew pt.



Cover Water Dry Tanks

HUNTER

Telephone Call Confirmation

Project No. 2900379-000

800-468-1501

Local _____ L.D. _____ Placed _____ Rec'd. _____ Date 6/4/90

B. Todd Conversed With Gary Lyons

Of Mid-America Plastics Regarding Hollow Plastic Spheres

Dia = 3/4"	1000	$39.40 /case + shipping
1 1/2"	1000	$143.50
2"	500	$123.00
4"	100	$203.00

Polypropylene or HDPE

90 fumes reduction

38.3 Evap. reduction

69.5 % fuel savings

water with ether (small amounts) and alcohol

Gary will fax product info to me today.

Distribution:

MID-AMERICA PLASTICS, INC.
Plastic Specialists / Fabrication & Distribution
700 Industrial Circle So.
Shakopee Minnesota 55379
612/445-7667 / FAX# 612/445-2974
800/488-1501

DATE: 4-6-90

TO: [illegible]

ATTN: BILL TODD X2653

Number of pages (Including this cover page): 2

REGARDING:

INFO ON PLASTIC BALLS

SIGNATURE: Gary Lyon
Mid-American Plastics, Inc.

MAP FAX #(612) 445-2974

THE ENERGY SAVERS and POLLUTION STOPPERS

PROVEN to Reduce Fuel Costs [illegible]9.5%
Reduces Fumes 90%
Reduces Evaporation [illegible]
ALL PLASTIC FLOATING SPHERES

Spheres float on surface of liquid in open tank and thereby greatly reduce the exposed liquid surface area — up to 90%. Dramatically diminishes objectionable fumes and odors. Blanket of spheres also insulates heated liquid reducing evaporation and heat requirements.

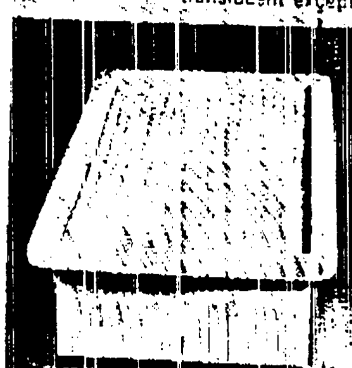
Ideal for plating tanks and similar open tank installations where the liquid surface can be covered with a blanket of spheres without impeding access to the tank for process purposes.

Spheres are hollow and will float on any liquid. Fully round. No welt or rim on which chemicals can deposit and being smooth they ensure a much tighter surface cover.

Polypropylene non-toxic and able to withstand continuous working temperatures of 110°C (230°F) polypropylene is suitable for use in most known chemicals.

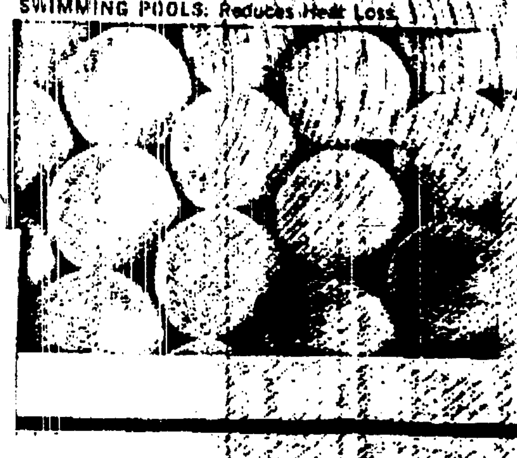
High Density Polyethylene generally suitable as above but with a continuous working temperature limitation of 80°C (176°F) softening point about 110°C (230°F). High density polyethylene has better chemical resistance to certain compounds like oil, and other hydro-carbons. Also less stress cracking at low temperatures than polypropylene. Color white translucent except 100 MM, black for outside use.

CUT HEAT LOSSES !
SAVE FACTORY MAINTENANCE !
IMPROVE SAFETY !
REMOVE FUMES AND ODORS !



APPLICATIONS

- **METAL WORKING** — In Pickling and Chromating Tanks.
- **PLATING:** Manual Chromium Line Reduces Spray Splashing.
- **PETROLEUM:** Air Pollution, Noxious Odors, Waste Collection Pits.
- **FOOD:** Reduces Vapor, Smell in Bacon Manufacturing.
- **POWER STATION:** Surge Tank Reservoir of Hot Boiler — No Steam.
- **SWIMMING POOLS:** Reduces Heat Loss.



POLYPROPYLENE		HIGH DENSITY POLYETHYLENE		DIMENSIONS			
Stock No.	Price Pr Case	Stock No.	Price Pr Case	Diameter MM	Approx. Size	No Required Per Sq Ft.	No. In Case

map MID-AMERICA PLASTICS, INC.
Plastic Specialists / Fabrication & Distribution
700 Industrial Circle S. • Shakopee, Minnesota 55379
Phone 612 445-7667

ECO Number: GP-N-8

REPLACE INCANDESCENTS WITH COLOR-CORRECTED HPS SCREW-INS FOR EXPLOSION-PROOF FIXTURES

Discussion

Many buildings at RAAP are lit by inefficient incandescent lighting for interior areas. This ECO evaluates replacement of the incandescent lamps in explosion-proof fixtures with 50 watt color-corrected HPS units, which consist of HPS lamps and ballasts with a medium base adapter which screws into the incandescent socket. These lamps have been color-corrected to produce a whitish light rather than a yellowish light usually associated with HPS. At the present time, these lamps are only produced in this wattage (50 W). Light levels will be decreased 33 percent when 200 W incandescents (3,710 lumens) are replaced by 50 W color-corrected HPS (2,500 lumens). When 150 W incandescents are replaced by 50 W color-corrected HPS, light levels will decrease 13 percent, from 2,880 lumens to 2,500 lumens.

Recommendations

Based on the Life Cycle Cost Analysis, it is recommended that 50 W HPS screw-in retrofits be installed in the interior incandescent explosion-proof fixtures.

Construction Cost	=	$147,062
Energy Savings (electricity)	=	2,354 MBtu/yr
Cost Savings	=	$31,081/yr
SIR	=	1.87
Simple Payback	=	4.8 years

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: GPN8
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID 1.035
INSTALLATION & LOCATION: RADFORD AAP — REGION NOS. 3 CENSUS: 3
PROJECT NO. & TITLE: GP-N-8 REPLACE INCAND. W/ COLOR-CORRECT HPS
FISCAL YEAR 1990 DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 10-05-90 ECONOMIC LIFE 15 YEARS PREPARED BY: T. TODD

1. INVESTMENT

A. CONSTRUCTION COST	$ 147062.
B. SIOH	$ 8089.
C. DESIGN COST	$ 8824.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9	$ 147578.
E. SALVAGE VALUE COST	-$ 0.
F. TOTAL INVESTMENT (1D-1E)	$ 147578.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 8.87	2354.	$ 20868.	8.78	183218.
B. DIST	$ .00	0.	$ 0.	12.34	0.
C. RESID	$ .00	0.	$ 0.	12.05	0.
D. NAT G	$ .00	0.	$ 0.	12.48	0.
E. COAL	$ .00	0.	$ 0.	10.01	0.
F. TOTAL		2354.	$ 20868.		$ 183218.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		$ 10213.
(1) DISCOUNT FACTOR (TABLE A)	9.11	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		$ 93040.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3Bd4)		$ 93040.
D. PROJECT NON ENERGY QUALIFICATION TEST		
(1) 25% MAX NON ENERGY CALC (2F5 X .33)	$ 60462.	
A IF 3D1 IS = OR > 3C GO TO ITEM 4		
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)=	1.65	
C IF 3D1B IS = > 1 GO TO ITEM 4		
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY		

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) $ 31081.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 276258.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 1.87
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 4.75

REYNOLDS, SMITH AND HILLS
ARCHITECTS • ENGINEERS • PLANNERS
INCORPORATED

SUBJECT RAAP Lighting Projects
DESIGNER T. Todd
CHECKER

AEP NO 290 0379 000
SHEET 1 OF 10
DATE
DATE

GP-N-8 REPLACE INCANDESCENTS WITH COLOR-CORRECTED HPS SCREW-INS FOR EXPLOSION PROOF FIXTURES

Calculations were made on a per-unit basis for installing 50 W HPS color-corrected units within the existing explosion-proof incandescent fixtures. The per-unit calculations are on page 2. Only areas operating 3 shifts/day, 5 days/wk were considered. From the building survey data, a list of the buildings with potential incandescent lighting projects was compiled (page 3). It is assumed for this ECO that 90% of the interior fixtures are explosion proof and can be retrofitted in this manner. Exact dimensions of fixtures and screw-in retrofits should be verified.

Total fixtures = 0.9(1536) = 1382

Energy Savings = 499 $\frac{kwh}{yr}$ × 0.003413 $\frac{MBtu}{kwh}$ × 1382 fixtures = 2354 $\frac{MBtu}{yr}$

Energy cost savings = $\frac{\$15.11}{yr \cdot fixture}$ × 1382 = \$20,882/yr

Maint & Labor cost savings = $\frac{\$7.39}{yr \cdot fix.}$ × 1382 = \$10,213/yr

Total cost savings = 20,882 + 10,213 = \$31,095/yr

Project cost = $\frac{\$118.65}{fixture}$ × 1382 = \$163,974

(Construction cost = \$163,974/1.115 = \$147,062)

Simple payback = $\frac{\$163,974}{\$31,095/yr}$ = 5.3 yr

GP-N-8 Replace interior 150-200 W incandescents with 50 W HPS screw-in retrofits for explosion-proof applications

- Assume color rendition is important in this area, so the 50 W HPS (color-corrected) is chosen even though lumens exceed requirements.

$$\text{Energy savings} = (158\text{ W} - 70\text{W}) \times 24\ \frac{\text{hr}}{\text{day}} \times 260\ \frac{\text{days}}{\text{yr}} = 499\ \frac{\text{kwh}}{\text{yr}}$$

$$\text{Energy cost savings} = 499\ \frac{\text{kwh}}{\text{yr}} \times \$0.03026\ \frac{}{\text{kwh}} = \$15.11\ \frac{}{\text{yr}}$$

$$\text{Labor + Matl cost savings} = \left(\frac{\text{Inrand cost}}{750\text{ hr}} - \frac{\text{HPS cost}}{12{,}000\text{ hr}}\right) \times 6240\ \frac{\text{hr}}{\text{yr}}$$

$$= \left[\frac{(\$2.11\text{ matl} + \$1.20\text{ labor} \times 0.683 \times 1.2)}{750\text{ hr}} - \frac{(\$30.00\text{ matl} + \$6.45\text{ labor} \times 0.683 \times 1.2)}{12{,}000\text{ hr}}\right]$$

$$\times 6240\ \frac{\text{hr}}{\text{yr}} = \$7.39\ \frac{}{\text{yr}}$$

$$\text{Total cost savings} = \$15.11\ \frac{}{\text{yr}} + \$7.39\ \frac{}{\text{yr}} = \$22.50\ \frac{}{\text{yr}}$$

Matl cost = $67.00 for fixture w/lamp (1590 retrofit kit)

Labor cost = $1.20 × 1.20 retrofit × 1.2 exp-proof × 0.683 = $1.18

Project Cost = [(1.045 × $67.00) + (1.2 × $1.18)] × 1.661 = $118.65

Simple payback = $\frac{\$118.65}{\$22.50/\text{yr}} = 5.3\text{ yr} < 10\text{ yr}$

Note: HPS lamps are replaceable in the retrofit ballasts.

Radford Army Ammunition Plant
List of Buildings with Incandescent Lighting

Bldg No	Name/Process	Location	Similar	Fixtures/Bldg.	Total Fixtures
1000 -00	Cotton Linter Warehouse	NC, A&B-Line	1	17	17
1606 -00	Open Tank Air Dry	Sol. Recovery, A-Line	10	20	200
1611 -00	Solvent Recovery House	Sol. Recovery, B-Line	27	12	324
3513 -00	C-1 Press & Cutting House	Green, C-Line	3	20	60
4912 -27	SG Curing Hse.- Carpet Rolls	Cast Prop. (Rocket)	10	5	50
4924 -06	Machine and Saw House	Cast Prop. (Rocket)	1	6	6
7106 -04	Dry House #4 (Cure Grain)	1st R P	7	8	56
9334 -15	Blender House	4th Rolled Powder	1	4	4
TOTAL FOR EXTERIOR FIXTURES					717
420 -02	Acid Waste Disposal (C-Line)	Waste Acid	1	8	8
2019 -00	Boiling Tub House	NC, B-Line	3	50	150
2022 -00	Beater House	NC, B-Line	3	40	120
2024 -00	Poacher & Blending House	NC, B-Line	3	30	90
3513 -00	C-1 Press & Cutting House	Green, C-Line	3	50	150
4912 -40	Forced Air Dry House	Pilot B	21	10	210
4912 -11	LG Mold Loading House	Cast Prop. (Rocket)	2	6	12
4912 -03	MK 43 Sawing and Inhibiting	Cast Prop. (Rocket)	1	4	4
4915 -00	Small Grain Mold Assembly	Cast Prop. (Rocket)	1	7	7
4921 -00	Inspect/Clean NG Tanks *	Cast Prop. (Rocket)	1	21	21
4951 -02	TOW Launch Saw House	Pilot B	1	8	8
5008 -01	15 Inch Press House	Pilot A	3	2	6
6304 -00	Paste Blending House	1st R P	1	20	20
7113 -00	Roll House (Rolled Powder)	1st R P (F-Line)	1	130	130
9310 -02	Rolled Powder Building	4th Rolled Powder	2	300	600
TOTAL FOR INTERIOR FIXTURES					1536

CONSTRUCTION COST ESTIMATE

DATE PREPARED 6/90 | SHEET 4 OF 10

PROJECT: ENERGY ENGINEERING ANALYSIS

LOCATION: RADFORD ARMY AMMUNITION PLANT

ARCHITECT ENGINEER: REYNOLDS, SMITH AND HILLS A.E.P., INC.

BASIS FOR ESTIMATE
- [x] CODE A (No design completed)
- [ ] CODE B (Preliminary design)
- [ ] CODE C (Final design)
- [ ] OTHER (Specify)

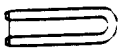
DRAWING NO. GP-N-8 | ESTIMATOR T. Todd | CHECKED BY

Incand. to 50W HPS SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
Replace incandescent	1382	fixt.	1.18	1631	67.00	92594	94225
lamps with 50 W HPS							
screw-in retrofits							
Sales Tax	4.5%					4167	4167
FICA / Insurance	20.0%			326			326
Subtotal				1957		96761	98718
Overhead	15.0%						14808
Profit	10.0%						11353
Performance Bond	1.0%						1249
Hercules Support	6.0%						7568
Contingency	10.0%						13370
Construction Cost							147066

ECP ENERGY CONSERVATION PRODUCTS, 511 CANAL STREET, NYC, NY, 10013—TEL (212)-925-5991

POWER CONSUMPTION AND LUMEN OUTPUT DATA

WATTS	LINE WATTS	TOTAL LUMEN OUTPUT	LUMENS PER WATT	HOURS OF RATED LIFE
********** MERCURY VAPOR (DELUXE WHITE)				
1000	1075	63000	59	24000
400	450	23000	56	24000
250	290	13000	42	24000
175	205	8500	49	24000
100	120	4500	42	24000
75	93	3150	37	16000
50	61	1680	31	16000
********** METAL HALIDE				
1500	1600	155000	103	3000
1000	1100	110000	100	12000
400	460	34000	85	15000
175	210	14000	85	7500
********** HIGH PRESSURE SODIUM				
1000	1080	140000	130	24000
400	480	50000	104	24000
250	310	27500	89	24000
150	200	16000	80	24000
100	135	9500	70	24000
70	85	5800	68	24000
50	70	4000	57	24000
35	42	2850	67	18000
**********FLUORESCENT				
STRAIGHT 40	48	3150	66	20000+
CIRCLINE 32	37	1830	50	12000+
CIRCLINE 22	25	1050	42	12000+
CIRCLINE 20	23	850	37	12000+
TWIN TUBE 13	16	900	56	10000+
TWIN TUBE 9	12	600	50	10000+
STRAIGHT 8	11	400	36	7500+
TWIN TUBE 7	10	400	40	10000+
STRAIGHT 6	9	300	33	7500+
TWIN TUBE 5	8	250	31	10000+
********** INCANDESCENT				
1000	1000	23740	24	1000
750	750	17040	23	1000
500	500	10850	22	1000
200	200	3710	19	750
150	150	2880	19	750
100	100	1750	18	750
75	75	1190	16	750
********** QUARTS—IODINE				
1500	1500	35800	24	3000
1000	1000	23400	23	2000
500	500	10950	22	2600
250	250	4850	19	2000



RAPID START FLUORESCENT U LAMPS

LAMP	WATTAGE	APPX LUMENS	AVERAGE LIFE HRS.	STANDARD CASE QTY.
FB40/U6/CW/EW	34	2,600	12,000	12
FB40/U6/CW	40	2,950	12,000	12

INSTANT START SLIMLINE FLUORESCENT LAMPS

F72T12/CW	55	4,550	12,000	12
F96T12/CW/EW	60	5,600	15,000	15
F96T12/CW	75	6,200	12,000	15

HIGH & VERY HIGH OUTPUT FLUORESCENT LAMPS

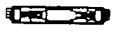
F96T12/CW/HO/EW	95	8,300	12,000	15
F96T12/CW/HO	110	9,200	12,000	15
F96T12/CW/VHO/EW	185	14,000	12,000	15
F96T12/CW/VHO	215	15,500	12,000	15

METAL HALIDE UNIVERSAL BURN MEDIUM BASE LAMPS

MH35/U	35	2,300	5,000	12
MH50/U	50	3,400	5,000	12
MH70/U	70	5,500	5,000	12
MH100/U	100	7,200	7,500	12
MH150/U	150	12,000	10,000	12

METAL HALIDE UNIVERSAL BURN MOGAL BASE LAMPS

MH175/U	175	14,000	10,000	12
MH175/C/U	175	14,000	10,000	12
MH250/U	250	20,500	10,000	12
MH250/C/U	250	20,500	10,000	12
MH400/U	400	36,000	20,000	6
MH400/C/U	400	36,000	20,000	6
MH1000/U	1000	110,000	12,000	6
MH1000/C/U	1000	105,000	12,000	6



COMPACT DOUBLE ENDED HQI METAL HALIDE LAMPS

HQI 70	70	5,000	10,000	12
HQI 150	150	11,000	10,000	12
HQI 250	250	19,000	10,000	12
HQI 400	400	25,000	10,000	12

HIGH PRESSURE SODIUM MEDIUM BASE LAMPS

LU35/MED	35	2,250	16,000	12
LU35/D/MED	35	2,150	16,000	12
LU50/MED	50	4,000	24,000	12
LU50/D/MED	50	3,800	24,000	12
LU70/MED	70	6,300	24,000	12
LU70/D/MED	70	5,985	24,000	12
LU100/MED	100	9,500	24,000	12
LU100/D/MED	100	8,800	24,000	12
LU150/MED	150	16,000	24,000	12
LU150/D/MED	150	15,000	24,000	12

COLOR IMPROVED HIGH PRESSURE SODIUM LAMP

MHT50SDX	50	2,500	12,000	12

HIGH PRESSURE SODIUM ED-23½ MOGUL BASE LAMPS

LU50	50	4,000	24,000	12
LU50/D	50	3,800	24,000	12
LU70	70	6,300	24,000	12
LU70/D	70	5,985	24,000	12
LU100	100	9,500	24,000	12
LU100/D	100	8,800	24,000	12
LU150/55	150	16,000	24,000	12
LU150/55/D	150	15,000	24,000	12

HIGH PRESSURE SODIUM E-18 MOGUL BASE LAMPS

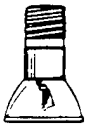
LU200	200	22,000	24,000	12
LU250	250	29,000	24,000	12
LU250/D	250	26,000	24,000	12
LU310	310	37,000	24,000	12
LU400	400	50,000	24,000	12

LOW PRESSURE SODIUM LAMPS

SOX10	10	1,000	9,000	20
SOX18	18	1,800	14,000	20
SOX35	35	4,800	18,000	12
SOX55	55	8,000	18,000	9
SOX90	90	13,500	18,000	9
SOX135	135	22,500	18,000	9
SOX180	180	33,000	18,000	9

MR16 LOW VOLTAGE 12V TUNGSTEN HALOGEN LAMPS

ESX (N)	20	3,300	2,000	20
BAB (W)	20	460	2,000	20
EYR (N)	42	7,300	2,000	20
EYS (M)	42	2,500	2,000	20
EYP (W)	42	1,200	2,000	20
EXT (N)	50	9,150	3,000	20
EXZ (M)	50	3,000	3,000	20
EXN (W)	50	1,500	3,000	20
EYF (N)	75	11,500	3,500	20
EYJ (M)	75	4,500	3,500	20
EYC (W)	75	2,000	3,500	20



MR16 LINE VOLTAGE 120V MEDIUM BASE TUNGSTEN HALOGEN LAMPS

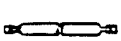
M/JDR75W/N	75	6,300	2,000	12
M/JDR75W/M	75	3,500	2,000	12
M/JDR75W/W	75	2,100	2,000	12
M/JDR100/N	100	8,500	2,000	12
M/JDR100/M	100	4,500	2,000	12
M/JDR100/W	100	3,000	2,000	12

MR16 LINE VOLTAGE 120V INTERMEDIATE BASE TUNGSTEN HALOGEN LAMPS

M/JDR75W/N	75	6,300	2,000	12
M/JDR75W/M	75	3,500	2,000	12
M/JDR75W/W	75	2,100	2,000	12
M/JDR100/N	100	8,500	2,000	12
M/JDR100/M	100	4,500	2,000	12
M/JDR100/W	100	3,000	2,000	12

TUNGSTEN HALOGEN LINE VOLTAGE MEDIUM BASE TUBULAR LAMPS

64484/CL	75	1,200	2,000	15
64484/FR	75	1,140	2,000	15
64486/CL	100	1,600	2,000	15
64486/FR	100	1,520	2,000	15
64488/CL	150	2,760	2,000	15
64488/FR	150	2,622	2,000	15



TUNGSTEN HALOGEN LINE VOLTAGE DOUBLE ENDED LAMPS

Q100T3/CL	100	1,600	200	12
Q150T3/CL	150	2,800	200	12
Q200T3/CL	200	3,600	200	12
Q300T3/CL	300	6,000	200	12
Q500T3/CL	500	11,000	200	12
Q1500T3/CL	1500	33,000	200	12

166 100 | Lighting

			CREW	DAILY OUTPUT	MAN-HOURS	UNIT	BARE COSTS MAT.	BARE COSTS LABOR	BARE COSTS EQUIP.	BARE COSTS TOTAL	TOTAL INCL O&P	
140	1600	90 watt	1 Elec	.30	26.670	C	5.140	645		5.785	6.600	140
	1650	135 watt		.20	40		6.905	970		7.875	9.025	
	1700	180 watt		.20	40		7.308	970		8.278	9.475	
	1750	Quartz line, clear, 500 watt		1.10	7.270		1.872	175		2.047	2.325	
	1760	1500 watt		.20	40		3.427	970		4.397	5.200	
	1800	Incandescent, interior, A21, 100 watt		1.60	5		173	120		293	370	
	1900	A21, 150 watt		1.60	5		211	120		331	410	
	2000	A23, 200 watt		1.60	5		227	120		347	430	
	2200	PS 30, 300 watt		1.60	5		330	120		450	540	
	2210	PS 35, 500 watt		1.60	5		576	120		696	810	
	2230	PS 52, 1000 watt		1.30	6.150		1.525	150		1.675	1.900	
	2240	PS 52, 1500 watt		1.30	6.150		2.382	150		2.532	2.850	
	2300	R30, 75 watt		1.30	6.150		375	150		525	630	
	2400	R40, 150 watt		1.30	6.150		408	150		558	670	
	2500	Exterior, PAR 38, 75 watt		1.30	6.150		566	150		716	840	
	2600	PAR 38, 150 watt		1.30	6.150		525	150		675	795	
	2700	PAR 46, 200 watt		1.10	7.270		1.928	175		2.103	2.375	
	2800	PAR 56, 300 watt		1.10	7.270		2.193	175		2.368	2.675	
	3000	Guards, fluorescent lamp, 4' long		1	8		375	195		570	695	
	3200	8' long		.90	8.890		535	215		750	905	
145	0010	RESIDENTIAL FIXTURES										145
	0400	Fluorescent, interior, surface, circline, 32 watt & 40 watt	1 Elec	20	.400	Ea.	48	9.70		57.70	67	
	0500	2' x 2', two U 40 watt		8	1		66	24		90	110	
	0700	Shallow under cabinet, two 20 watt		16	.500		45	12.15		57.15	67	
	0	Wall mounted, 4'L, one 40 watt, with baffle		10	.800		41	19.40		60.40	74	
	2000	Incandescent, exterior lantern, wall mounted, 60 watt		16	.500		36	12.15		48.15	57	
	2100	Post light, 150W, with 7' post		4	2		104	49		153	185	
	2500	Lamp holder, weatherproof with 150W PAR		16	.500		16	12.15		28.15	35	
	2550	With reflector and guard		12	.667		31	16.15		47.15	58	
	2600	Interior pendent, globe with shade, 150 watt		20	.400		78	9.70		87.70	100	
150	0010	TRACK LIGHTING										150
	0080	Track, 1 circuit, 4' section	1 Elec	6.70	1.190	Ea.	33	29		62	79	
	0100	8' section		5.30	1.510		48	37		85	105	
	0200	12' section		4.40	1.820		81	44		125	155	
	0300	3 circuits, 4' section		6.70	1.190		36	29		65	82	
	0400	8' section		5.30	1.510		48	37		85	105	
	0500	12' section		4.40	1.820		88	44		132	160	
	1000	Feed kit, surface mounting		16	.500		12	12.15		24.15	31	
	1100	End cover		24	.333		1.98	8.10		10.08	14.05	
	1200	Feed kit, stem mounting, 1 circuit		16	.500		16	12.15		28.15	35	
	1300	3 circuit		16	.500		16	12.15		28.15	35	
	2000	Electrical joiner for continuous runs, 1 circuit		32	.250		6.55	6.05		12.60	16.10	
	2100	3 circuit		32	.250		12.10	6.05		18.15	22	
	2200	Fixtures, spotlight, 150 PAR		16	.500		47	12.15		59.15	70	
	3000	Wall washer, 250 watt tungsten halogen		16	.500		101	12.15		113.15	130	
	3100	Low voltage, 25/8 watt, 1 circuit		16	.500		102	12.15		114.15	130	
	3120	3 circuit		16	.500		109	12.15		121.15	140	

166 100 | Lighting

			CREW	DAILY OUTPUT	MAN-HOURS	UNIT	BARE COSTS MAT.	BARE COSTS LABOR	BARE COSTS EQUIP.	BARE COSTS TOTAL	TOTAL INCL O&P	
135	5100	175 watt metal halide	1 Elec	8	1	Ea.	479	24		503	565	135
	5110	250 watt metal halide		8	1		500	24		524	585	
	5120	150 watt high pressure sodium		8	1		535	24		559	625	
	5130	250 watt high pressure sodium		8	1		556	24		580	645	
	5140	72"H 18" sq., 400 watt metal halide		8	1		525	24		549	615	
	5150	250 watt high pressure sodium		8	1		556	24		580	645	
	5160	400 watt high pressure sodium	↓	8	1	↓	581	24		605	675	
	5190	Portable rectangle, 6" high 13.5" x 20"										
	5200	175 watt metal halide	1 Elec	12	.667	Ea.	293	16.15		309.15	345	
	5210	250 watt metal halide		12	.667		314	16.15		330.15	370	
	5220	150 watt high pressure sodium		12	.667		335	16.15		351.15	390	
	5230	250 watt high pressure sodium		12	.667		360	16.15		376.15	420	
	5240	8" high 18" x 24", 400 watt metal halide		12	.667		365	16.15		381.15	425	
	5250	250 watt high pressure sodium		12	.667		376	16.15		392.15	435	
	5260	400 watt high pressure sodium		12	.667		398	16.15		414.15	460	
	5270	Portable square, 15" high 13.5" sq., 175 watt metal halide		12	.667		324	16.15		340.15	380	
	5280	250 watt metal halide		12	.667		376	16.15		392.15	435	
	5290	150 watt high pressure sodium		12	.667		360	16.15		376.15	420	
	5300	250 watt high pressure sodium		12	.667		386	16.15		402.15	450	
	5400	Pendent 16" round/square, 175 watt metal halide		3.20	2.500		355	61		416	480	
	5410	250 watt metal halide		2.70	2.960		370	72		442	515	
	5420	400 watt metal halide		2.40	3.330		398	81		479	555	
	5430	150 watt high pressure sodium		3.20	2.500		398	61		459	525	
	[illegible]	250 watt high pressure sodium		2.70	2.960		428	72		500	575	
	[illegible]	400 watt high pressure sodium	↓	2.40	3.330	↓	454	81		535	620	
140	0010	LAMPS										140
	0080	Fluorescent, rapid start, cool white, 2' long, 20 watt	1 Elec	1	8	C	348	195		543	670	
	0100	4' long, 40 watt		.90	8.890		198	215		413	535	
	0120	3' long, 30 watt		.90	8.890		442	215		657	805	
	0150	U-40 watt		.80	10		874	245		1,119	1,325	
	0170	4' long, 35 watt energy saver		.90	8.890		270	215		485	615	
	0200	Slimline, 4' long, 40 watt		.90	8.890		618	215		833	995	
	0300	8' long, 75 watt		80	10		577	245		822	990	
	0350	8' long, 60 watt energy saver		.80	10		603	245		848	1,025	
	0400	High output, 4' long, 60 watt		.90	8.890		750	215		965	1,150	
	0500	8' long, 110 watt		.80	10		775	245		1,020	1,200	
	0520	Very high output, 4' long, 110 watt		.90	8.890		1,285	215		1,500	1,725	
	0550	8' long, 215 watt		.70	11.430		1,285	275		1,560	1,825	
	0600	Mercury vapor, mogul base, deluxe white, 100 watt		.30	26.670		2,142	645		2,787	3,300	
	0650	175 watt		.30	26.670		1,663	645		2,308	2,775	
	0700	250 watt		.30	26.670		2,968	645		3,613	4,225	
	0800	400 watt		.30	26.670		2,340	645		2,985	3,525	
	0900	1000 watt		.20	40		5,100	970		6,070	7,025	
	1000	Metal halide, mogul base, 175 watt		.30	26.670		3,749	645		4,394	5,075	
	1100	250 watt		.30	26.670		4,712	645		5,357	6,125	
	1200	400 watt		.30	26.670		4,386	645		5,031	5,775	
	1300	1000 watt		.20	40		9,894	970		10,864	12,300	
	1320	1000 watt, 125,000 initial lumens		.20	40		9,960	970		10,930	12,400	
	[illegible]	1500 watt		.20	40		9,268	970		10,238	11,600	
	[illegible]	Sodium high pressure, 70 watt		.30	26.670		4,712	645		5,357	6,125	
	1360	100 watt		.30	26.670		4,871	645		5,516	6,300	
	1370	150 watt		.30	26.670		5,059	645		5,704	6,525	
	1380	250 watt		.30	26.670		5,380	645		6,025	6,875	
	1400	400 watt		.30	26.670		5,727	645		6,372	7,250	
	1450	1000 watt		.20	40		13,352	970		14,322	16,100	
	1500	Low pressure, 35 watt		.30	26.670		3,963	645		4,608	5,300	
	1550	55 watt	↓	.30	26.670	↓	4,386	645		5,031	5,775	

HUNTER **Telephone Call Confirmation**

Project No. 290 0379 000

Local ____ L.D. (718) 851-4577 Placed ✓ Rec'd. ✓ Date 6-7-90

T. Todd Conversed With Mr. Singer

Of American Scientific Lighting Co. Regarding HPS retrofits

For retrofits of incandescent fixtures, the "Bulb Lumenight" and "Colorlight" products are recommended. The lamps are replaceable in both, and the "colorlight" is more whitish. Fixtures costs (including lamp) for quantities of 100+ are as follows:

Bulb Lumenight 35 W — $45 (lamps only $16 - $20)
50 W — $45
(also come in 70 W, 100 W, 150 W)

Colorlight 50 W — $67 (lamps only $30)

They will send a copy of their catalog for dimensions.

Distribution:

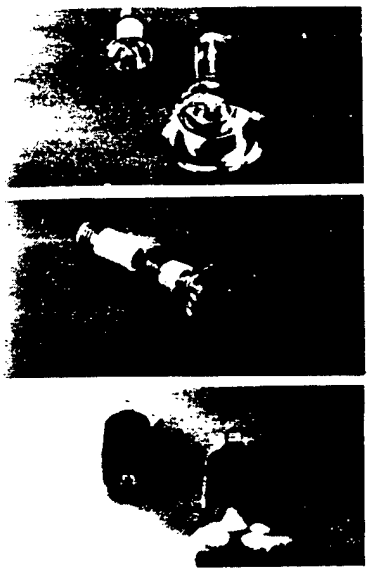
DOWNLITE™ CONVERSION SERIES: *COMPACT FLUORESCENT REFLECTOR LAMPS*

GLOBE FLECTOR™ LUMA FLECTOR™

- **LAMP:** Compact disposable fluorescent globe or tubular lamp/Standard or tapered base
- **REFLECTOR:** Highly polished aluminum
- **WATTAGE:** Fifteen
- **LUMENS:** 1350
- **COLOR:** Warm white/2800k
- **USE:** Indoor only
- **BURNING POSITION:** Any
- **LAMP LIFE:** 9,000 hours
- **INSTALLATION:** Screws into any 120V medium base socket
- **PACKAGING:** Ten conversions per carton

CATALOG NUMBER	LAMP	DIMENSIONS
DGF S/15	BFG15 LE/A	Reflector Diameter 5⅛" Overall Length 6¼"
DGF T/15	BFG15 LE/T	Reflector Diameter 5⅛" Overall Length 6¾"
DLF S/15	BFT15 LE/A	Reflector Diameter 5⅛" Overall Length 6⅜"
DLF T/15	BFT15 LE/T	Reflector Diameter 5⅛" Overall Length 7"

LINE VOLTAGE/LOW VOLTAGE *MR16 HALOGEN CONVERSIONS*



HALOGENLITE™ 120V

- **LAMP:** MR16 Dichro-Cool tungsten halogen/Medium base or intermediate with medium adapter base and clip on lens/Line voltage/Cool crisp white light 3000k/Dimmable up to twenty five percent/Medium beam spread.
- **LAMP LIFE:** 2,000 hours/High lumen maintenance
- **INSTALLATION:** Screws directly into any ventilated 120V medium base porcelin socket rated above 100 watt/Minimum front diameter opening 4¾"
- **PACKAGING:** Ten lamps per carton

CATALOG NUMBER	LAMP	DIMENSIONS
MEDIUM		
DH 120 M/75	JDR75	Lamp Diameter 2"
DH 120 M/100	JDR100	Overall Length 2 5/16"
INTERMEDIATE		
DH 120 I/75	JDR75	Lens Diameter 2⅛"
DH 120 I/100	JDR100	Overall Length 5⅜"
OPTIONS:		M Medium Beam Spread 18°
R Reflector		
N Narrow Beam Spread 10°		W Wide Beam Spread 28°

HALOGENLITE™ 12V

- **ADAPTER:** Molded Valox® plastic/Vented to cool internal components
- **FINISH:** Black
- **LAMP:** MR16 Dichro-Cool tungsten halogen/Low voltage/Stepdown transformer/Dimmable/Cool crisp white light 3000k/Natural sunlight appearance
- **LIFE:** 2000 hours – 20 watt/3000 hours – 50 watt
- **INSTALLATION:** DH 12/20 screws into any medium base porcelin socket rated for 75 watts/DH 12/50 into socket rated for 150 watts
- **PACKAGING:** Four conversions per carton/Lamp included

CATALOG NUMBER	LAMP	DIMENSIONS
DH 12/20	JR/20	Adapter Diameter 3¼"
DH 12/50	JR50	Overall Length 6"
DH 12/20/R40	JR/20	Adapter Diameter 3¼"
DH 12/50/R40	JR/50	Overall Length 7¾" Lens Diameter 5"
OPTIONS:		EXT Narrow Spot/50w
BAB Flood/20w		EXZ Narrow Flood/50w
ESX Narrow Spot/20w		EXN Flood/50w

COLOR IMPROVED *HPS HIGH HAT CONVERSION*

COLORLITE 50™

- **ADAPTER:** Heavy gauge spun aluminum
- **FINISH:** Caustic etching
- **REFLECTOR:** Highly polished aluminum/Vented slots for cool operation
- **LAMP COLOR:** 2500K • **LAMP LIFE:** 12000 Hours
- **INSTALLATION:** Adapter screws into a standard 120V high hat fixture/Medium base porcelain socket required/Fixture rated for a minimum of 150 watts/Minimum front diameter opening 5"
- **PACKAGING:** Four conversions per carton/Lamp included

CATALOG NUMBER	LAMP	DIMENSIONS
DC/50	NHT50 SDX	Adapter Diameter 3⅛" Reflector Diameter 5¼" Overall Height 8½"

AMERICAN SCIENTIFIC LIGHTING CORPORATION • BROOKLYN, NEW YORK • TEL. (800) 552-3465 • (718) 851-4577 • FAX (718) 853-2390

ECO Number: GP-N-2

REPLACE INCANDESCENTS WITH CIRCLINE FLUORESCENTS

Discussion

Many buildings at RAAP are lit with inefficient incandescent lighting. This ECO analyzes the replacement of interior incandescent lamps with 32 W circline fluorescent screw-in retrofit fixtures. This type of project is suitable for nonexplosion-proof interior fixtures. Replacing 100 W incandescents with 32 W circlines would increase the lumen output by five percent, from 1,750 lumens to 1,830 lumens. Replacing 150 W incandescents with 32 W circlines would decrease the lumen output 57 percent, from 2,880 lumens to 1,830 lumens.

Recommendations

Based on the Life Cycle Cost Analysis, it is recommended that incandescent lamps be replaced with fluorescent circline fixtures.

Construction Cost	=	$13,048
Annual Energy Savings (electricity)	=	371 MBtu/yr
Annual Cost Savings	=	$6,416/yr
SIR	=	4.38
Simple Payback	=	2.0 years

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: GPN2
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID 1.035
INSTALLATION & LOCATION: RADFORD AAP — REGION NOS. 3 CENSUS: 3
PROJECT NO. & TITLE: GP-N-2 REPLACE INCAND. W/ CIRCLINE FLUOR.
FISCAL YEAR 1990 DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 10-05-90 ECONOMIC LIFE 15 YEARS PREPARED BY: T. TODD

1. INVESTMENT

A. CONSTRUCTION COST	$	13048.
B. SIOH	$	718.
C. DESIGN COST	$	783.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9	$	13094.
E. SALVAGE VALUE COST	-$	0.
F. TOTAL INVESTMENT (1D-1E)	$	13094.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 8.87	371.	$ 3285.	8.78	28845.
B. DIST	$ .00	0.	$ 0.	12.34	0.
C. RESID	$ .00	0.	$ 0.	12.05	0.
D. NAT G	$ .00	0.	$ 0.	12.48	0.
E. COAL	$ .00	0.	$ 0.	10.01	0.
F. TOTAL		371.	$ 3285.		$ 28845.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		$ 3131.
(1) DISCOUNT FACTOR (TABLE A)	9.11	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		$ 28523.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3Bd4)		$ 28523.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 9519.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)= 2.93
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) $ 6416.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 57368.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 4.38
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 2.04

REYNOLDS, SMITH AND HILLS
ARCHITECTS • ENGINEERS • PLANNERS
INCORPORATED

SUBJECT RAAP Lighting Projects — AEP NO 290 0379 000
DESIGNER T. Todd — SHEET 1 OF 11
CHECKER — DATE
DATE

GP-N-2 REPLACE INCANDESCENTS WITH CIRCLINE FLUORESCENTS

Calculations were made on a per-unit basis for installing 32 W circline fluorescent fixtures in place of incandescents for interior non-explosion proof applications. The per-unit calculations are on page 2. From the building survey data, a list of the buildings with potential incandescent lighting projects was compiled (page 3). It is assumed for this ECO that 10% of the interior fixtures are non-explosion proof and can be retrofitted in this manner. Only areas operating 3 shifts/day, 5 days/wk were considered.

Total fixtures = $0.1 \times 1536 = 154$

Energy savings = $70.5 \frac{\text{kwh}}{\text{yr}} \times 0.003413 \frac{\text{MBtu}}{\text{kwh}} \times 154 = 37.1 \text{ MBtu/yr}$

Energy cost savings = $\frac{\$21.34}{\text{yr-fixture}} \times 154 \text{ fixtures} = \$3286/\text{yr}$

Matl & labor cost savings = $\frac{\$20.33}{\text{yr-fixture}} \times 154 = \$3131/\text{yr}$

Total cost savings = $3286 + 3131 = \$6417/\text{yr}$

Project cost = $\frac{\$94.47}{\text{fixture}} \times 154 = \$14,548$

((Construction cost = $14,548 / 1.115 = \$13,048$)

Simple payback = $\frac{\$14,548}{\$6417/\text{yr}} = 2.3 \text{ yr}$

REYNOLDS, SMITH AND HILLS
ARCHITECTS • ENGINEERS • PLANNERS
INCORPORATED

SUBJECT RAAP Lighting Projects Screening Calcs
DESIGNER T. Todd
CHECKER

AEP NO 290 0379 000
SHEET 2 OF 11
DATE
DATE

GP-N-2. Replace interior 100-150W incandescents with 32 W screw-in fluorescent fixtures for non-explosion proof applications

- Assume original light levels should not be reduced significantly.

(32 W fluor. provides lumen output between 100W and 150W incand.)

$$\text{Energy savings} = (150\,W - 37\,W) \times \frac{24\,hr}{day} \times \frac{260\,days}{yr} = 705\ \frac{kwh}{yr}$$

$$\text{Energy cost savings} = 705\ \frac{kwh}{yr} \times \frac{\$0.03026}{kwh} = \frac{\$21.34}{yr}$$

$$\text{Labor \& mat'l cost savings} = \left(\frac{\text{Incand. cost}}{750\ hr} - \frac{\text{Fluor. cost}}{12{,}000\ hr}\right) \times \frac{6240\ hr}{yr}$$

$$= \left[\frac{(\$2.11\ \text{mat'l} + \$1.20\ \text{labor} \times 0.683)}{750\ hr} - \frac{(\$5.55 \times 1.1\ \text{mat'l} + \$2.45\ \text{labor} \times 0.683)}{12{,}000\ hr}\right] \times \frac{6240\ hr}{yr} = \frac{\$20.33}{yr}$$

$$\text{Total cost savings} = \frac{\$21.34}{yr} + \frac{\$20.33}{yr} = \frac{\$41.67}{yr}$$

Mat'l cost = \$42.90 for fixture × 1.10 inflation (1984 vendor literature)
+ \$5.55 for lamp × 1.10 infl. = \$53.30

Labor cost = \$1.20 × 1.20 × 0.683 (cost of replacing incand. bulb + 20%)

Project cost = $[(1.045 \times \$53.30) + (1.2 \times \$0.98)] \times 1.661 = \$94.47$

$$\text{Simple payback} = \frac{\$94.47}{\$41.67/yr} = 2.3\ yr < 10\ yr.$$

Radford Army Ammunition Plant
List of Buildings with Incandescent Lighting

Bldg No	Name/Process	Location	Similar	Fixtures/Bldg.	Total Fixtures
1000 -00	Cotton Linter Warehouse	NC, A&B-Line	1	17	17
1606 -00	Open Tank Air Dry	Sol. Recovery, A-Line	10	20	200
1611 -00	Solvent Recovery House	Sol. Recovery, B-Line	27	12	324
3513 -00	C-1 Press & Cutting House	Green, C-Line	3	20	60
4912 -27	SG Curing Hse.- Carpet Rolls	Cast Prop. (Rocket)	10	5	50
4924 -06	Machine and Saw House	Cast Prop. (Rocket)	1	6	6
7106 -04	Dry House #4 (Cure Grain)	1st R P	7	8	56
9334 -15	Blender House	4th Rolled Powder	1	4	4
TOTAL FOR EXTERIOR FIXTURES					717
420 -02	Acid Waste Disposal (C-Line)	Waste Acid	1	8	8
2019 -00	Boiling Tub House	NC, B-Line	3	50	150
2022 -00	Beater House	NC, B-Line	3	40	120
2024 -00	Poacher & Blending House	NC, B-Line	3	30	90
3513 -00	C-1 Press & Cutting House	Green, C-Line	3	50	150
4912 -40	Forced Air Dry House	Pilot B	21	10	210
4912 -11	LG Mold Loading House	Cast Prop. (Rocket)	2	6	12
4912 -03	MK 43 Sawing and Inhibiting	Cast Prop. (Rocket)	1	4	4
4915 -00	Small Grain Mold Assembly	Cast Prop. (Rocket)	1	7	7
4921 -00	Inspect/Clean NG Tanks *	Cast Prop. (Rocket)	1	21	21
4951 -02	TOW Launch Saw House	Pilot B	1	8	8
5008 -01	15 Inch Press House	Pilot A	3	2	6
6304 -00	Paste Blending House	1st R P	1	20	20
7113 -00	Roll House (Rolled Powder)	1st R P (F-Line)	1	130	130
9310 -02	Rolled Powder Building	4th Rolled Powder	2	300	600
TOTAL FOR INTERIOR FIXTURES					1536

CONSTRUCTION COST ESTIMATE	DATE PREPARED 6/90	SHEET 4 OF 11

PROJECT: ENERGY ENGINEERING ANALYSIS

LOCATION: RADFORD ARMY AMMUNITION PLANT

ARCHITECT ENGINEER: REYNOLDS, SMITH AND HILLS A.E.P., INC.

BASIS FOR ESTIMATE
- [x] CODE A (No design completed)
- [ ] CODE B (Preliminary design)
- [ ] CODE C (Final design)
- [ ] OTHER (Specify) _____

DRAWING NO.: GP-N-2

ESTIMATOR: T. Todd

CHECKED BY:

Incand. to fluor. SUMMARY

	QUANTITY		LABOR		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
Replace incandescent lamps with 32W fluor. circline screw-ins	154	fixt.	0.98	151	53.30	8208	8359
Sales tax	4.5%					369	369
FICA / Insurance	20.0%			30			30
Subtotal				181		8577	8758
Overhead	15.0%						1314
Profit	10.0%						1007
Performance Bond	1.0%						111
Hercules Support	6.0%						671
Contingency	10.0%						1186
Construction Cost							13047

GP-N-2 p.5 of 11

ECP ENERGY CONSERVATION PRODUCTS, 511 CANAL STREET, NYC, NY, 10013—TEL (212)-925-5991

POWER CONSUMPTION AND LUMEN OUTPUT DATA

WATTS	LINE WATTS	TOTAL LUMEN OUTPUT	LUMENS PER WATT	HOURS OF RATED LIFE
********* MERCURY VAPOR (DELUXE WHITE)				
1000	1075	63000	59	24000
400	450	23000	56	24000
250	290	13000	42	24000
175	205	8500	49	24000
100	120	4500	42	24000
75	93	3150	37	16000
50	61	1680	31	16000
********* METAL HALIDE				
1500	1600	155000	103	3000
1000	1100	110000	100	12000
400	460	34000	85	15000
175	210	14000	85	7500
********* HIGH PRESSURE SODIUM				
1000	1080	140000	130	24000
400	480	50000	104	24000
250	310	27500	89	24000
150	200	16000	80	24000
100	135	9500	70	24000
70	85	5800	68	24000
50	70	4000	57	24000
35	42	2850	67	18000
*********FLUORESCENT				
STRAIGHT 40	48	3150	66	20000+
CIRCLINE 32	37	1830	50	12000+
CIRCLINE 22	25	1050	42	12000+
CIRCLINE 20	23	850	37	12000+
TWIN TUBE 13	16	900	56	10000+
TWIN TUBE 9	12	600	50	10000+
STRAIGHT 8	11	400	36	7500+
TWIN TUBE 7	10	400	40	10000+
STRAIGHT 6	9	300	33	7500+
TWIN TUBE 5	8	250	31	10000+
********* INCANDESCENT				
1000	1000	23740	24	1000
750	750	17040	23	1000
500	500	10850	22	1000
200	200	3710	19	750
150	150	2880	19	750
100	100	1750	18	750
75	75	1190	16	750
********* QUARTS—IODINE				
1500	1500	35800	24	3000
1000	1000	23400	23	2000
500	500	10950	22	2600
250	250	4850	19	2000

166 100 | Lighting

			CREW	DAILY OUTPUT	MAN-HOURS	UNIT	BARE COSTS MAT.	BARE COSTS LABOR	BARE COSTS EQUIP.	BARE COSTS TOTAL	TOTAL INCL O&P	
140	1600	90 watt	1 Elec	.30	26.670	C	5,140	645		5,785	6,600	140
	1650	135 watt		.20	40		6,905	970		7,875	9,025	
	1700	180 watt		.20	40		7,308	970		8,278	9,475	
	1750	Quartz line, clear, 500 watt		1.10	7.270		1,872	175		2,047	2,325	
	1760	1500 watt		.20	40		3,427	970		4,397	5,200	
	1800	Incandescent, interior, A21, 100 watt		1.60	5		173	120		293	370	
	1900	A21, 150 watt		1.60	5		211	120		331	410	
	2000	A23, 200 watt		1.60	5		227	120		347	430	
	2200	PS 30, 300 watt		1.60	5		330	120		450	540	
	2210	PS 35, 500 watt		1.60	5		576	120		696	810	
	2230	PS 52, 1000 watt		1.30	6.150		1,525	150		1,675	1,900	
	2240	PS 52, 1500 watt		1.30	6.150		2,382	150		2,532	2,850	
	2300	R30, 75 watt		1.30	6.150		375	150		525	630	
	2400	R40, 150 watt		1.30	6.150		408	150		558	670	
	2500	Exterior, PAR 38, 75 watt		1.30	6.150		566	150		716	840	
	2600	PAR 38, 150 watt		1.30	6.150		525	150		675	795	
	2700	PAR 46, 200 watt		1.10	7.270		1,928	175		2,103	2,375	
	2800	PAR 56, 300 watt		1.10	7.270		2,193	175		2,368	2,675	
	3000	Guards, fluorescent lamp, 4' long		1	8		375	195		570	695	
	3200	8' long		.90	8.890		535	215		750	905	
145	0010	RESIDENTIAL FIXTURES										145
	0400	Fluorescent, interior, surface, circline, 32 watt & 40 watt	1 Elec	20	.400	Ea.	48	9.70		57.70	67	
	0500	2' x 2', two U 40 watt		8	1		66	24		90	110	
	0700	Shallow under cabinet, two 20 watt		16	.500		45	12.15		57.15	67	
	0900	Wall mounted, 4'L, one 40 watt, with baffle		10	.800		41	19.40		60.40	74	
	2000	Incandescent, exterior lantern, wall mounted, 60 watt		16	.500		36	12.15		48.15	57	
	2100	Post light, 150W, with 7' post		4	2		104	49		153	185	
	2500	Lamp holder, weatherproof with 150W PAR		16	.500		16	12.15		28.15	35	
	2550	With reflector and guard		12	.667		31	16.15		47.15	58	
	2600	Interior pendent, globe with shade, 150 watt		20	.400		78	9.70		87.70	100	
150	0010	TRACK LIGHTING										150
	0080	Track, 1 circuit, 4' section	1 Elec	6.70	1.190	Ea.	33	29		62	79	
	0100	8' section		5.30	1.510		48	37		85	105	
	0200	12' section		4.40	1.820		81	44		125	155	
	0300	3 circuits, 4' section		6.70	1.190		36	29		65	82	
	0400	8' section		5.30	1.510		48	37		85	105	
	0500	12' section		4.40	1.820		88	44		132	160	
	1000	Feed kit, surface mounting		16	.500		12	12.15		24.15	31	
	1100	End cover		24	.333		1.98	8.10		10.08	14.05	
	1200	Feed kit, stem mounting, 1 circuit		16	.500		16	12.15		28.15	35	
	1300	3 circuit		16	.500		16	12.15		28.15	35	
	2000	Electrical joiner for continuous runs, 1 circuit		32	.250		6.55	6.05		12.60	16.10	
	2100	3 circuit		32	.250		12.10	6.05		18.15	22	
	2200	Fixtures, spotlight, 150 PAR		16	.500		47	12.15		59.15	70	
	3000	Wall washer, 250 watt tungsten halogen		16	.500		101	12.15		113.15	130	
	3100	Low voltage, 25/8 watt, 1 circuit		16	.500		102	12.15		114.15	130	
	3120	3 circuit		16	.500		109	12.15		121.15	140	

166 100 | Lighting

			CREW	DAILY OUTPUT	MAN-HOURS	UNIT	BARE COSTS MAT.	BARE COSTS LABOR	BARE COSTS EQUIP.	BARE COSTS TOTAL	TOTAL INCL O&P
135	5100	175 watt metal halide	1 Elec	8	1	Ea.	479	24		503	565
	5110	250 watt metal halide		8	1		500	24		524	585
	5120	150 watt high pressure sodium		8	1		535	24		559	625
	5130	250 watt high pressure sodium		8	1		556	24		580	645
	5140	72"H 18" sq., 400 watt metal halide		8	1		525	24		549	615
	5150	250 watt high pressure sodium		8	1		556	24		580	645
	5160	400 watt high pressure sodium		8	1		581	24		605	675
	5190	Portable rectangle, 6" high 13.5" x 20"									
	5200	175 watt metal halide	1 Elec	12	.667	Ea.	293	16.15		309.15	345
	5210	250 watt metal halide		12	.667		314	16.15		330.15	370
	5220	150 watt high pressure sodium		12	.667		335	16.15		351.15	390
	5230	250 watt high pressure sodium		12	.667		360	16.15		376.15	420
	5240	8" high 18" x 24", 400 watt metal halide		12	.667		365	16.15		381.15	425
	5250	250 watt high pressure sodium		12	.667		376	16.15		392.15	435
	5260	400 watt high pressure sodium		12	.667		398	16.15		414.15	460
	5270	Portable square, 15" high 13.5" sq., 175 watt metal halide		12	.667		324	16.15		340.15	380
	5280	250 watt metal halide		12	.667		376	16.15		392.15	435
	5290	150 watt high pressure sodium		12	.667		360	16.15		376.15	420
	5300	250 watt high pressure sodium		12	.667		386	16.15		402.15	450
	5400	Pendent 16" round/square, 175 watt metal halide		3.20	2.500		355	61		416	480
	5410	250 watt metal halide		2.70	2.960		370	72		442	515
	5420	400 watt metal halide		2.40	3.330		398	81		479	555
	5430	150 watt high pressure sodium		3.20	2.500		398	61		459	525
	5440	250 watt high pressure sodium		2.70	2.960		428	72		500	575
	5450	400 watt high pressure sodium		2.40	3.330		454	81		535	620
140	0010	LAMPS									
	0080	Fluorescent, rapid start, cool white, 2' long, 20 watt	1 Elec	1	8	C	348	195		543	670
	0100	4' long, 40 watt		.90	8.890		198	215		413	535
	0120	3' long, 30 watt		.90	8.890		442	215		657	805
	0150	U-40 watt		.80	10		874	245		1,119	1,325
	0170	4' long, 35 watt energy saver		.90	8.890		270	215		485	615
	0200	Slimline, 4' long, 40 watt		.90	8.890		618	215		833	995
	0300	8' long, 75 watt		.80	10		577	245		822	990
	0350	8' long, 60 watt energy saver		.80	10		603	245		848	1,025
	0400	High output, 4' long, 60 watt		.90	8.890		750	215		965	1,150
	0500	8' long, 110 watt		.80	10		775	245		1,020	1,200
	0520	Very high output, 4' long, 110 watt		.90	8.890		1,285	215		1,500	1,725
	0550	8' long, 215 watt		.70	11.430		1,285	275		1,560	1,825
	0600	Mercury vapor, mogul base, deluxe white, 100 watt		.30	26.670		2,142	645		2,787	3,300
	0650	175 watt		.30	26.670		1,663	645		2,308	2,775
	0700	250 watt		.30	26.670		2,968	645		3,613	4,225
	0800	400 watt		.30	26.670		2,340	645		2,985	3,525
	0900	1000 watt		.20	40		5,100	970		6,070	7,025
	1000	Metal halide, mogul base, 175 watt		.30	26.670		3,749	645		4,394	5,075
	1100	250 watt		.30	26.670		4,712	645		5,357	6,125
	1200	400 watt		.30	26.670		4,386	645		5,031	5,775
	1300	1000 watt		.20	40		9,894	970		10,864	12,300
	1320	1000 watt, 125,000 initial lumens		.20	40		9,960	970		10,930	12,400
	1330	1500 watt		.20	40		9,268	970		10,238	11,600
	1350	Sodium high pressure, 70 watt		.30	26.670		4,712	645		5,357	6,125
	1360	100 watt		.30	26.670		4,871	645		5,516	6,300
	1370	150 watt		.30	26.670		5,059	645		5,704	6,525
	1380	250 watt		.30	26.670		5,380	645		6,025	6,875
	1400	400 watt		.30	26.670		5,727	645		6,372	7,250
	1450	1000 watt		.20	40		13,352	970		14,322	16,100
	1500	Low pressure, 35 watt		.30	26.670		3,963	645		4,608	5,300
	1550	55 watt		.30	26.670		4,386	645		5,031	5,775

GP-N-1 p. 3 of 11

ECP ENERGY CONSERVATION PRODUCTS
511 CANAL STREET NEW YORK, N.Y. 10013

EFFECTIVE 3/1/84
(212)925-5991

LAMP PRICES

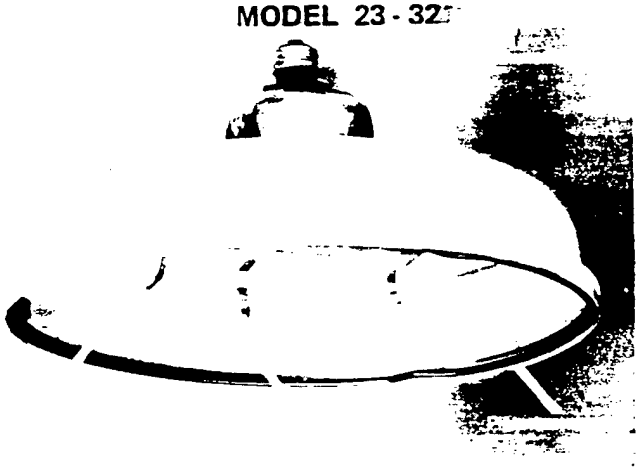
ORDERING CODE	TYPE	WATTAGE	LIST	CONT.	MIN QTY
F4T5/CW	FLUORESCENT	4	6.37	3.19	12
F4T5/WW	FLUORESCENT	4	7.17	3.59	12
F6T5/CW	FLUORESCENT	6	6.37	3.20	12
F6T5/WW	FLUORESCENT	6	8.79	4.40	12
F8T5/CW	FLUORESCENT	8	6.03	3.02	12
F8T5/WW	FLUORESCENT	8	7.15	3.58	12
FC6T9/CW	FLUORESCENT	20	10.00	5.00	12
FC6T9/WW	FLUORESCENT	20	11.35	5.68	12
FC8T9/CW	FLUORESCENT	22	10.00	5.00	12
FC8T9/WW	FLUORESCENT	22	11.35	5.68	12
FC12T9/CW	FLUORESCENT	32	11.10	5.55	12
FC12T9/WW	FLUORESCENT	32	12.50	6.25	12
FC16T9/CW	FLUORESCENT	40	13.00	6.50	12
FC16T9/WW	FLUORESCENT	40	14.75	7.38	12
PL-7	FLUORESCENT	7	13.00	6.50	10
PL-9	FLUORESCENT	9	13.00	6.50	10
PL-13	FLUORESCENT	13	14.00	7.00	10
LU-35	H.P.S.	35	70.00	35.00	6
LU-50	H.P.S.	50	70.00	35.00	6
LU-70	H.P.S.	70	70.00	35.00	6
LU-100	H.P.S.	100	80.00	40.00	6
LU-150	H.P.S.	150	80.00	40.00	6
ESX (NARROW)	QUARTZ HALOGEN	20	20.00	10.00	4
EAB (WIDE)	QUARTZ HALOGEN	20	20.00	10.00	4
EXT (NARROW)	QUARTZ HALOGEN	50	21.00	10.50	4
EXN (WIDE)	QUARTZ HALOGEN	50	21.00	10.50	4
EYF (NARROW)	QUARTZ HALOGEN	75	22.00	11.00	4
EYC (WIDE)	QUARTZ HALOGEN	75	22.00	11.00	4

****

ORDERS UNDER MINIMUM ADD 10%

• SAVE OVER $62.00 PER FIXTURE, PER YEAR

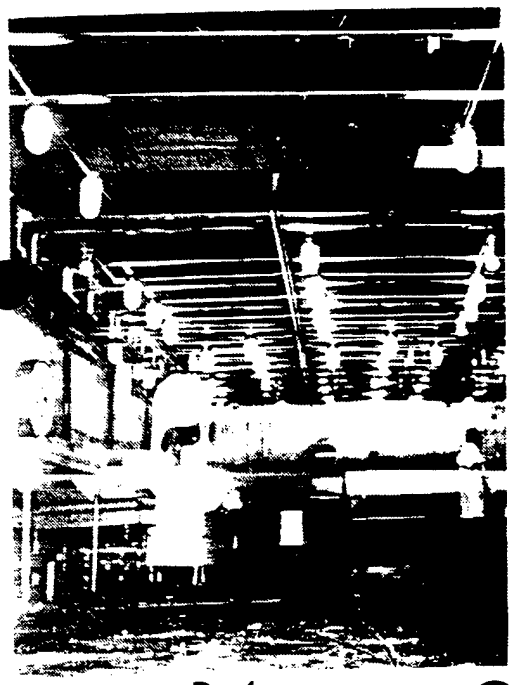
MODEL 23 - 32



UL

with 32 watt screw-in flourescent fixture... replaces 150 watt bulb

(available in 54 watts)



Before

Advantages

1. Immediate savings (no rewiring)
2. Long life (12,000 hrs)
3. Unbreakable (poly carbonate) lens
4. Reduced heat load (saves on refrigeration costs)
5. Easy cleaning
6. Equal illumination

After

COMPARE COSTS*

150 watt RS/TF incandescent bulb vs. 32 watt flourescent screw-in				savings
Energy Cost	$46.80	vs	$11.54 (including ballast)	$32.56
Lamp & maintenance cost	$21.31	vs	$ 1.82	$19.49
By reducing the heat load caused by the incandescent bulb, you can achieve additional savings on refrigeration costs				$10.85
*Based on 12 hour burn, 5 days per week			Total Savings	$62.90

DISTRIBUTED BY:

MFG. BY ep® NEW YORK

GP-11-2 p. 10 of 11

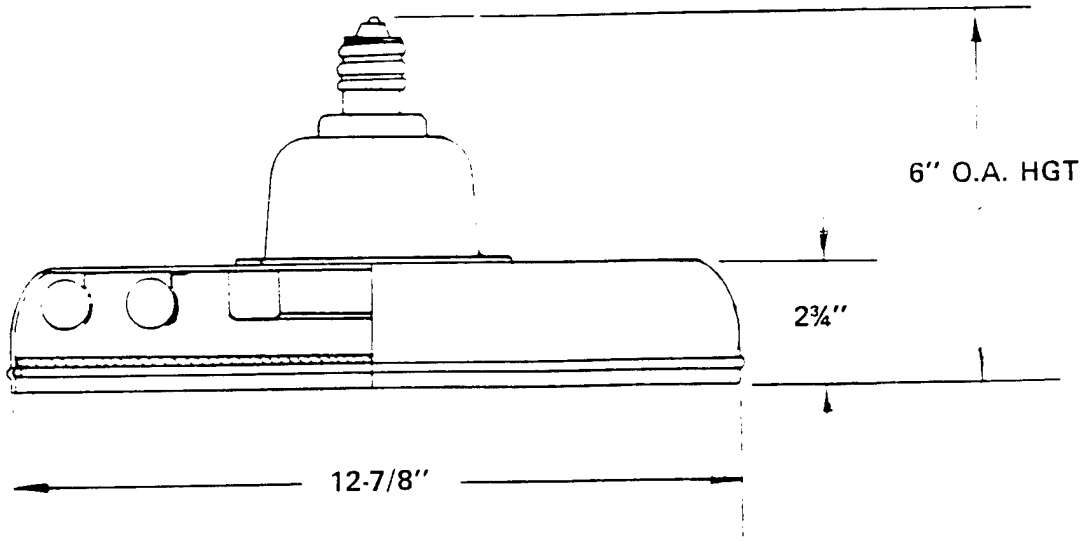
TWIST OF THE WRIST® BRAND ENERGY SAVING LIGHTING FIXTURES

MODEL 23 32 WATT OR 54 WATT

SOCKET: Standard Medium Base **HOUSING:** Aluminum **DIFFUSER:** Clear Polycarbonate

BALLAST: Robertson R32AP-WS (32 watt)
Robertson R2232P-WS (54 watt)

MODEL #	LAMP	WATTAGE	TEMPERATURE RANGE
23-32	FC12T10	32	Down to 32°F
23-54	FC12T10	32	Down to 32° F
	FC8T9	22	
23-32-0'	FC12T10	32	Down to 0° F
23-54-0'	FC12T10	32	Down to 0° F



UL LISTED

ECP ENERGY CONSERVATION PRODUCTS
511 CANAL STREET NEW YORK, N.Y. 10013 (212)925-5991

EFFECTIVE 3/1/84

PRICING - MODEL # 23 SCREW-IN FLUORESCENT CONVERSIONS

FIXTURE PRICES DO NOT INCLUDE LAMPS.

MODEL	DESCRIPTION	LIST	CONT.	MIN QTY
23-32 ======	32 WATT SCREW IN FLUORESCENT FIXTURE (WHITE FINISH) WITH LEXAN DIFFUSER.	85.80	42.90	3
23-54 ======	54 WATT SCREW IN FLUORESCENT FIXTURE (WHITE FINISH) WITH LEXAN DIFFUSER.	99.30	49.65	3
	OPTIONS			
DIFFUSER	N - WITHOUT LEXAN DIFFUSER DEDUCT	9.90	4.95	-
BALLAST	V - 277 VOLT BALLAST	12.00	6.00	
	0 - ZERO DEGREE BALLAST(DOWN TO 0 F) 32WATT	16.00	8.00	-
	54WATT	16.00	8.00	-

STANDARD MODEL BALLAST WILL LIGHT DOWN TO 32 F. ORDERS BELOW MINIMUM ADD 10%

PRICING - MODEL #25 RECESSED CEILING FIXTURE RETRO-FIT

FIXTURE PRICES DO NOT INCLUDE LAMP.

MODEL	DESCRIPTION	LIST	CONT.	MIN QTY
25-20-DW =========	20 WATT RECESSED FLUORESCENT CONVERSION FIXTURE WITH SCREW IN ADAPTOR AND WHITE ACRYLIC DIFFUSER (WHITE FINISH)	91.80	45.90	5
25-22-DW =========	22 WATT - SAME AS ABOVE	104.00	52.00	100
	OPTIONS			
DIFFUSER	PQ - PARASQUARE	13.40	6.70	-
	PA - PARAHEX	14.90	7.45	-
BODY TYPE	A - ADJUSTABLE STEM		CONSULT FACTORY...	
BALLAST	C - COLD WEATHER BALLAST	14.00	7.00	-

ORDERS BELOW MINIMUM ADD 10%